creative computing
the magazine of recreational and educational computing
vol 1, no 6
Nov-Dec 1975
$1.50

COMPUTER THREAT TO SOCIETY

Isaac Asimov: Life & Times of Multivac

Interview with Senator John V. Tunney

Technology: Doomsday for Individualism?

Turning On With Computer Art

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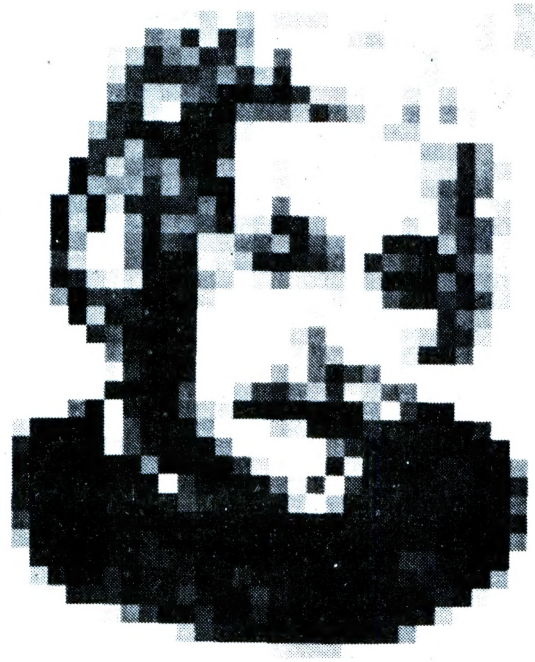

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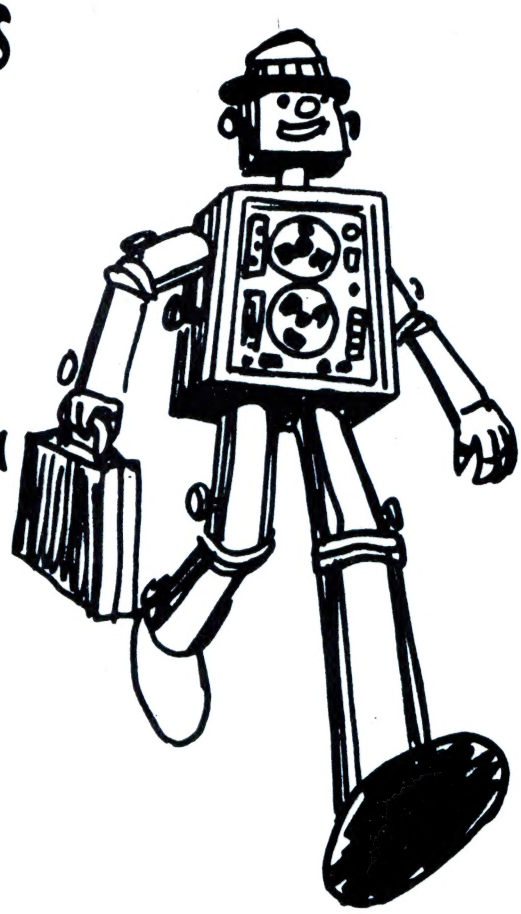

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In This Issue of CREATIVE COMPUTING

COMPUTER IMPACT ON SOCIETY ISSUE

SPECIAL FEATURES

The Computer — Threat to Society? An Interview with Senator John V. Tunney 44
Survey of Public Attitudes Towards Computers 49

FICTION, POETRY

The Life and Times of Multivac — Isaac Asimov 8
Poems by Peter Payack 40

THINGS TO DO

Surveys, The Census, and Privacy 14
Puzzles 17
Reading, Writing, and Computing 18
Technology . . . Doomsday for Individualism? 20

ARTICLES

Technical Transport Problems 26
Flying Buffalo 27
Eclectic Programming Languages 28
"Very Good. Please Continue." 29
Computer Abuse: The Need for a Rational Perspective 30
Putting Teeth Into Privacy Legislation 45
Industry Leaders Testify at Privacy Hearings 46
Record-keeping in the Space Age 47
One Manufacturer Looks at Data Privacy 48
How Much Privacy Should You Have? 53
Memoirs of an Ex-Social Security Number Giver 55
Prosecutor Management Information System 56
A Computerized Criminal Justice System 57
Embezzler's Guide to the Computer 58
Credit Card Crooks 59
Waiting For the Great Computer Rip-Off 60
Turning On With Computer Art 61
Developing New Communications Media 63
Community Memory 64
Supermarkets Are Going Bananas Over Computers 65

NEWS, NOTES, SOURCES

Computer Recreations Corporation 22
Compleat Computer Catalogue 23
Creative Computing Compendium 33
World Computers in Education Conference 42
National Student Computer Fair 43
NBS Privacy Conference 52

DEPARTMENTS

Input/Output 4
Editorial 6
Poster 38
Reviews 68
Feature Review 72
(34 Books on BASIC)

THE COVER

Our cover artist, Craig Johnson of Ravenna, Ohio calls his Moire face ogre a "poor man's approach to computer graphics." He feels that the use of Moires in design is "sort of like painting with pure mathematics which basis is, of course, computer-relatable."

"Span-o-Vision" on the back cover is also the product of Craig's talented hand and fertile imagination.

Input/Output

Some words from the giant . . . .

Dear Editor:

Thank you for your letter of June 24 asking me to participate in *Creative Computing* magazine's November-December issue on the computer and society.

Many of us within IBM are intensively seeking answers to a number of the problems touched upon in your questionnaire. For example, those questions dealing with privacy and data security are addressed in the enclosed statement by Dr. Lewis Branscomb, IBM Vice President and Chief Scientist, in testimony given before a subcommittee of the House of Representatives.*

The role of the computer in society is, of course, only part of a broader area dealing with the role of technology in general. We recognize that the computer, like any instrument of technology, can be a force for good or harm depending upon the use to which it is put.

IBM's past experience and future outlook reassure me that the computer, in virtually every instance, will be used for good, not harm and that this technological tool will continue to fulfill its great promise.

Frank T. Cary
Chairman of the Board, IBM

**See a summary of this testimony on page 46. - DHA.*

Computers save congressmen time in voting. (Does that mean more talk or more vacations?)

Dear Editor:

I appreciate your invitation to present my views on the role of computers in society. Computer support to the House of Representatives began in the late 1960's when the Clerk of the House introduced data processing equipment as a means of administering several clerical tasks. In 1971, the Committee on House Administration established the House Information Systems staff to provide a professional base for computer activities. This staff continues to act under the guidance and leadership of the Committee on House Administration, currently chaired by the Honorable Wayne L. Hays of Ohio.

The members of the House are constantly aware of the utility and the importance of computers in our society: the electronic voting system, for example, was used for nearly 1500 rollcalls during the 93rd Congress and saved approximately 500 hours of legislative time that would otherwise have been needed to answer rollcalls under the manual method. The House computer has also been applied to many other useful tasks including a bill status system, committee calendar system, data analysis services and administrative support systems. The Committee on Science and Technology has been a frequent user of these systems.

I look forward to the appearance of your November-December 1975 issue as it sounds extremely interesting.

Olin E. Teague
Chairman, Committee on Science and Technology
U.S. House of Representatives

Good Opportunities!

Dear Editor:

Perhaps some of your readers might want to consider teaching overseas. The United States Dependents Schools, European Area (USDESEA) is strongly moving into instructional uses of the computer. Twenty-three high schools throughout Europe have on-site Interdata 7/16 Systems with 12 more computer systems and a variety of peripherals on order.

USDESEA solicits knowledgeable, experienced, enthusiastic computer-oriented teachers who can help American young people receive an education relevant to the world of today and of the future. Write to:

Deputy Chief of Staff for Personnel
Dependents School Teacher Recruitment Branch
Department of the Army
The Pentagon, Room 1-A-658
Washington, D. C. 20310.

Also interested in your intentions would be:

USDESEA Computer Coordinators
Darmstadt Career Center
APO, NY 09175

who can also supply you with additional information.

Gerald Akkerhuis
USDESEA

Any opinions or answers?

Dear Editor:

I would like to hear from you, your readers, or anyone who has informed opinions in the following areas:

1. Why should/shouldn't everyone have a computer or terminal in his home?
2. Are there BASIC cross-compilers or other liberators around to get you into another language with a decent I/O capability, a reasonable way to define structured data, a non-restrictive symbolic label set, and other tools which users of high (and not so high) level languages kind of take for granted?
3. How much should I spend for a micro-processor based system? Does anyone know a reliable way to get service on a kit?
4. Why is 8/12/16/24/32/48/60 bit word better/worse?

Thanks again for your interest and help. Best of luck with *Creative.*

Ted Kramer
475 Encinal Ave., Apt B ,Menlo Park, CA

Lurking Klingon agents?

Dear Editor:

I was pleasantly surprised with your letter – quite often the big wheels in the computer world give me a run around (how's that for mixing metaphors!!!).

I like Leedom's game in the May-Jun *Creative Computing*. With all due respect to Bob Leedom, the best Star Trek in existence, by far, is TREK73 by William K. Char. It has 29 commands, and the bad guys think too, not just sit around. The objects actually 'move' through simulated space. Vessels, antimatter probes, and torpedoes. You can also jettison engineering, self destruct, or pull a Corbomite bluff.

A few thoughts about your magazine:

– I like the attempt to emphasize non-military games very much.

– Don't put writing on the poster!!!!! (Like the name of the mag.)

– Don't overdo the pollution stuff.

– T-shirt is a great idea.

Steve North
Newfoundland, NJ

*I have been approached by * beep * Book Company to put together a book of Space Games. 1. What do you readers think (i.e., would you buy it?), and 2. How about sending some game contributions (even tho' I edited* 101, *I'm sure there are loads of space games – and others – that I haven't seen. Like Char's TREK73. Send them!)? –DHA*

Dear Editor:

In your Volume 1, Number 4 issue (May-June) you make reference in your Notices, etc. column to posters available of *Dr.* Spock. Obviously, there must be a Klingon agent lurking around your office since the first officer of the Enterprise is *Mr.* Spock.

Actually, this is a quite common error. It is, however, an interesting philosophical point that since Mr. Spock has obtained the computer rating of 'A-7' (is certification coming?) that he probably *should* be referred to as 'Doctor'.

Bob Leedom's Star Trek game is about the best I've run across, and plays very well. I have an extremely klugy version in APL (a somewhat restricted subset of Super Star Trek) which I'll be glad to trade with anyone who is interested. It does work, however, and when I put it out in the public library at one of the local college systems, APL usage went up something like 200%, or so I've heard.

R. 'Bob' R. Wier
Ft. Worth, TX

Fame and glory (but no $)

Dear Editor:

With thanks I received your letter of August 3, 1975 and sample issue of *Creative Computing*.

I believe that my communication presented at the 3rd International Congress of Cybernetics, "Happiness Amplified Cybernetically" is too scholarly to be reprinted in your interesting magazine – although the ideas expressed therein might be very suitable for your purposes.

[Ed note: the article sounds fascinating. Send a copy and let me decide if it's suitable –DHA]

I have presented many other communications at different congresses of cybernetics in Europe. Would you be interested in publishing them as a booklet or in the magazine?

I think that it might be more suitable for you if I should write "original articles" for which you might be in a position to cover my expenses.

Ali Irtem
Istanbul, Turkey

Ed Note: Creative Computing *is always seeking interesting, original manuscripts, articles, fiction, poetry, etc. However, as compensation, authors will have to be satisfied with fame and glory since we do not pay for contributions (except in rare, extraordinary cases). –DHA*

CAI – A failure?

Dear Editor:

I propose that the reason why CAI has failed is because computer experts have not yet found a way to code human fallibility. The best teaching of human beings is by sensitive but fallible teachers. Why, in CAI, is it always assumed that the student is the one who will make the mistakes?

J. D. Tinsley
Inspector of Schools
Birmingham Education Department
Council House, Birmingham, England

How about some comment or opinion from other readers on the failure of CAI? –DHA

May-June Issue – More Controversy

Dear Editor:

First, a complaint. You know that I am an enthusiastic supporter of *Creative Computing* (which is better than being an athletic supporter). But I have to lodge a complaint about the rather crude "City of the Future" which appeared in the May-June issue. There are too many good things happening in the pages of *Creative Computing* to allow junk like that to accompany them. There may be a place for that kind of sick comment, but I don't think that it's a journal where the quality of the material published is so far beyond the quality of the paper used. I'll gladly put up with newsprint so long as the things I'm reading aren't cheap too. There. I've said it and I'm glad.

Paul Emmerich
Dana College

Dear Editor:

This letter is to inform you that I found a certain item in your May-June 1975 issue to be the most repugnant, backward and revolting snippet of the English language that I have ever, in all my young life, had the misfortune to come across. It so violated propriety and the rights of your readers, that I felt forced to write this letter.

Do I refer, I hear you thinking, to R. Crumbs excellent, amusing and surprisingly original cartoon 'City of the Future'? No, I do not. In retrospect, I am surprised only that he wasted his talents throwing pearls before swine.

Do I refer, perhaps, to the skilled spoofery masquerading as an illustration on page 19? No, I do not. I have respect for your Elder.

Aha!! you cry, I must object to the relevant if irreligious review de book on page 71 . . . Nope, not that either. (ah, God inertia, pupil of ignorance, forgive such blasphemy, lest it distract you from your loyal service with the forces of entropy).

But . . . Tucked inside the front cover was an announcement which was an obscenity I find impossible to forgive. In it you apologized for the best features of your magazine, and earnestly promised any offending, I mean offended, readers that you would not interrupt their religious or moral fantasy worlds with any such slight incursions of reality in the future. Bravo, and welcome to the ranks of ignorance and superstition; unreason and unreality. May you proudly wave your ticket to the gates of Infamy – your profound disservice to your customers, a few of whom may actually take seriously the basic tenents of science which you trample over, to whit, openmindedness, freedom from prejudice, and an impartial gathering of all information. Personally, I find it difficult to believe that any of the items you apologized for would be offensive to your readers, since by definition they must be literate, and likely, logical people not prone to devoting themselves to such superstitions as selecting certain etymological structures with magic powers of defilement, or assigning normal anatomical structures with terrible powers of debasement upon the glance of mortal eyes.

As for myself, I may yet send in a subscription to your magazine, it being the 'only game in town'. But even if temptation should yield to you my money, you'll never again gain my respect.

Russell Johnston
Calgary, Alberta

The Computer Threat to Society

From the supermarket shelf you pick up two different brands of dishwasher detergent intending to buy the least expensive one. The stock person apparently forgot to put the price cards on the shelf. So you look at the boxes. But all you find on each is a postage-stamp size area with a series of lines of different thicknesses. No price.

What has happened is that the store has switched to a computerized UPC system. UPC stands for Universal Product Code and for supermarkets it's a great time saver. Prices no longer have to be marked on each item; the check-out clerk simply passes the "bar code" (that series of lines) over an optical scanner which is hooked to a computer in the back of the store. The computer transmits the current price back to the register where it is displayed on a little screen and printed on the register tape.

But what's good for the supermarket may not necessarily be good for you, particularly if you're a comparison shopper and the shelves aren't well marked. Are you being deprived of your right to be a comparison shopper by the computer? Certainly not. The computer is only doing what it has been programmed to do. It's not the villain. In fact, if the system reduces store overhead, prices might even come down a little.

But UPC is indicative of the little ways that the computer is invading our lives. Yes, and even threatening them. No, not the computer itself, but the things it makes possible. With UPC, people are being forced to make a change that some of them don't want to make. Let's take a look at some of the other ways things made possible by the computer are invading and, in fact, threatening our lives.

Fraud

So much has been written about the use of computers to defraud, the possibilities should be well known by now. Fraud by manipulating the software is most common (Equity Funding, the use of a terminal to order the delivery of over $1 million in equipment from Pacific Telephone, a New York bank teller reassigning small amounts from every transaction to his own account, etc.). But hardware fraud is becoming popular, too — telephone "Blue Boxes" for example.

Yours truly — threat to society? Image made by a Digivue Display Hard Copy Unit (Varian Graphics, Palo Alto).

Influence on Elections

Public opinion polls and surveys are taken before every major election using minute sample sizes. Of course, the samples are demographically balanced and supposedly representative of the nation or state as a whole. Computers are then programmed to project these samples and predict the outcome of an entire election. The same sort of thing is done on election day using the results from early-reporting precincts. What influence do these predictions have on the actual election? Do people vote for the predicted winner because they want to join the bandwagon? Do others give up in despair? No one can say for sure, but it is clear that there is some effect and it is probably undesirable.

Inconvenience

High on the list of citizen complaints about the computer is the difficulty of correcting incorrect charge account or bank statements. We've all heard of horror stories in which an item was purchased, then returned 10 days later. The purchase price is carried on the statement for one month but interest on the unpaid balance is charged for the next 6 months or so until a human finally reads one of the letters of explanation. Worse yet, that person might be labeled a delinquent payee in a computerized credit data bank and, at some subsequent time, have difficulty getting a car loan, Sears card, mortgage, check cashed (choose one or more).

Although computerized charge accounts, bank statements, stock registrations, etc. have been around for about 20 years, most companies today are doing an inadequate job as intermediaries between the customer and the computer. The infrequent exception is a newsworthy event. For example, the grandson of Marybeth McKinney in Winnetka, Ill. recently ate her AT&T debenture interest check. Mrs. McKinney contemplated the challenge of trying to get through a computer to obtain a replacement check. She wrote AT&T and received a prompt answer from Cynthia Nelson who wrote, "I am sorry to learn that your grandson decided to chew up your check. I hope it did not make him sick." A new check was mailed and the story appeared in the *Chicago Tribune* titled "A Taste of AT&T Minus Computer Bite." The fact that business courtesy becomes a newspaper headline is indicative of the degree of everyday inconvenience and harassment we have learned to put up with from our servant, the computer.

Physical Harm

When "computer threat" is mentioned, most people tend to think of inconvenience, invasion of privacy, or criminal fraud. Yet perhaps the most threatening aspects of computers are inadvertent errors or program bugs. It is a rare program of any size or complexity that doesn't have

one or more bugs even after years of successful operation. The bug may be in a subroutine that is used only infrequently or it may be in a very complex set of calculations where it is difficult to recognize an error. (You may say, but isn't the program tested and debugged when it is written? In theory, yes. But where there are millions of possible paths through a program it generally is checked by another computer program — and what if there is an error in that one?)

What are the consequences of such errors? In a word, scary! They're unpredictable, potentially very damaging, and, even after they occur, may not be correctly identified or even recognized. Not only that, but they could well cause physical harm as well as the more common inconvenience and financial loss. For example, the computerized control system on BART failed to take into account the possibility of a certain type of malfunction in a sensor. Result — a very damaging crash.

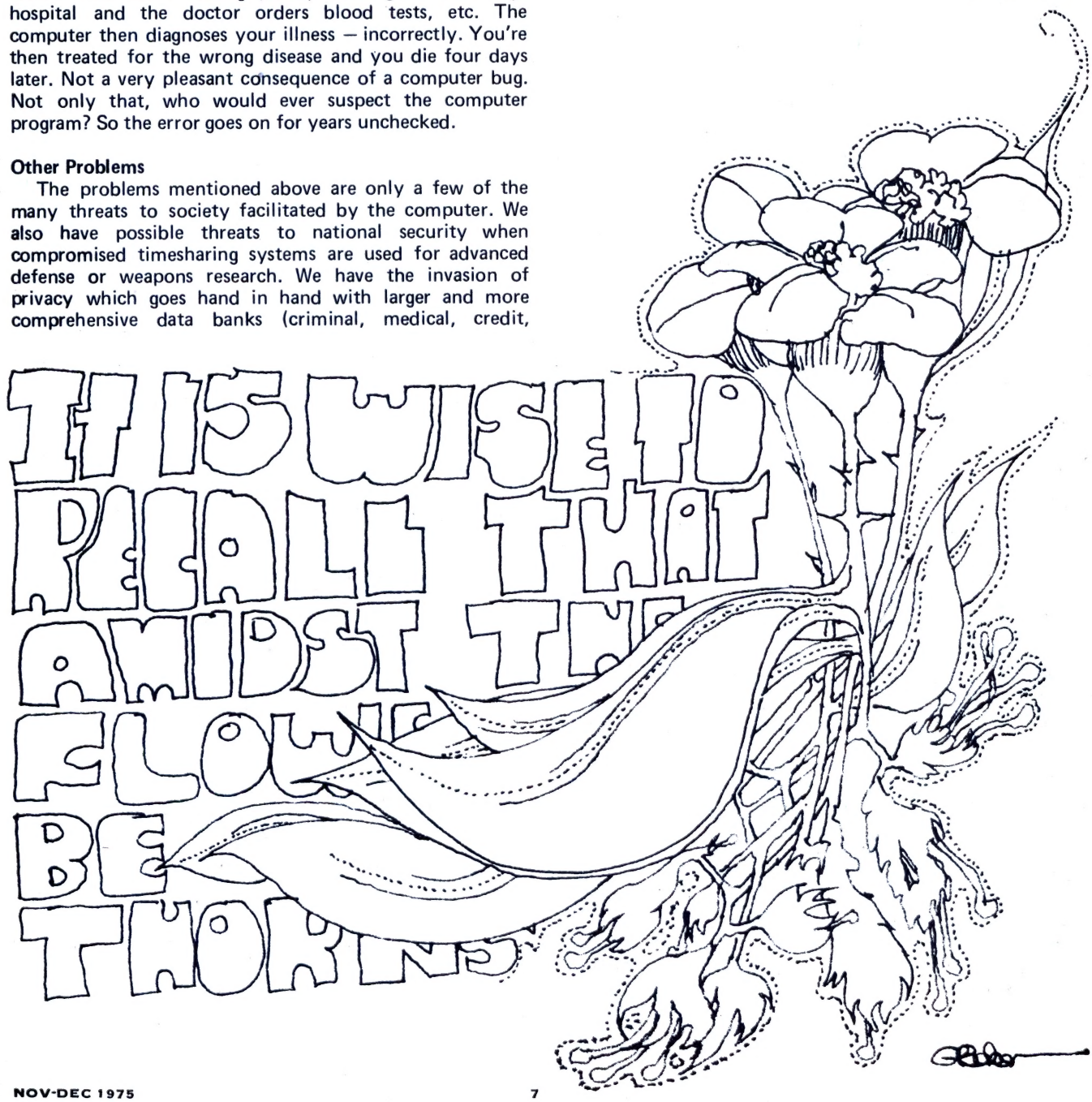
What about the computer diagnostic systems used in virtually every large pathology laboratory? Let's say you return from Zaire feeling poorly. You go into a large hospital and the doctor orders blood tests, etc. The computer then diagnoses your illness — incorrectly. You're then treated for the wrong disease and you die four days later. Not a very pleasant consequence of a computer bug. Not only that, who would ever suspect the computer program? So the error goes on for years unchecked.

Other Problems

The problems mentioned above are only a few of the many threats to society facilitated by the computer. We also have possible threats to national security when compromised timesharing systems are used for advanced defense or weapons research. We have the invasion of privacy which goes hand in hand with larger and more comprehensive data banks (criminal, medical, credit, consumer opinion). We have pranks and practical jokes such as the McDonald's contest in Southern California and the student who insured the life of his goldfish. We also have the threat of becoming excessively dependent on the computer to do things that we used to do via experiment. Thus an engineer or scientist today may be deprived of the practical and valuable learning experience which results from an experiment which fails.

Are these undesirable problems the fault of the computer? Emphatically, NO. They occur more easily because the computer exists. The impersonal, mechanical computer is a convenient scapegoat to blame when the real problem may lie with the input data, the system's design, or the execution of the program. We must recognize that as the computer extends our intellect it also extends our capability and speed of making errors, of committing crime, of forcing change, of invading privacy, and of causing inconvenience. We must also recognize that along with the computer's tremendous power to facilitate beneficial advances for society is an equal power to cause problems.

David H. Ahl



Assume the world has ended in catastrophe and ask what then of the literature of change

The life and times of Multivac

By Isaac Asimov

Science fiction is the literature of change. It is the only form of fiction which, as a matter of definition, tells its story against the background of a society vastly different from our own, with the difference dependent on changes in science and technology.

Since we live in a period of rapid change, science fiction has become the relevant literature of today, particularly to young people who must face such change for the rest of their lives.

The attempt to work out reasonably changed societies led science-fiction writers to consider such matters as television, nuclear bombs, and interplanetary exploration long before most scientists and government leaders (let alone the general public) did so. This has lent science fiction an air of respectability. All these factors combined have even raised it to the ultimate, and somewhat dubious, height of academic acceptance.

What's more, science fiction offers a technique of unlimited flexibility for dealing with today's problems.

At the present moment, for instance, the question of man versus machine is exercising many minds. Argue the matter from the immediate standpoint of today and you will obscure it with numerous emotional hangups and side issues. Take it, instead, several centuries hence. Assume that today's world has ended in catastrophe but that the remnants of technology have saved the remnants of mankind. Assume that a new world has arisen in which the problem is stark and simple, in which men are few indeed and the machine powerful beyond present dreams. Now raise the same question of man versus machine, and we have . . ."The life and times of Multivac."

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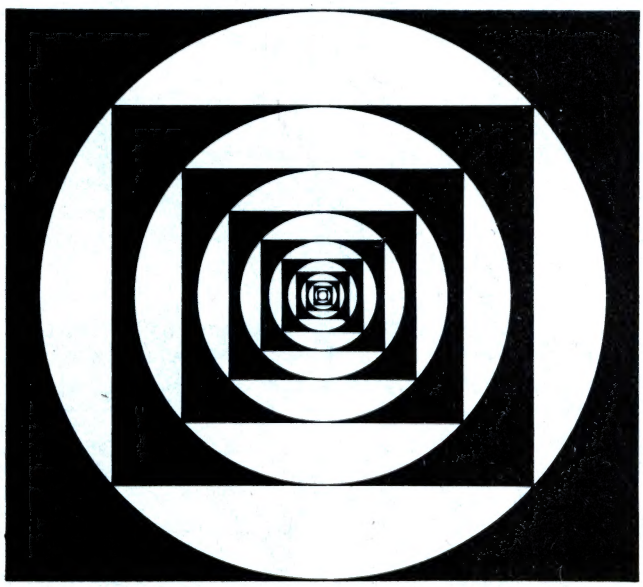


The whole world was interested. The whole world could watch. If anyone wanted to know how many did watch, Multivac could have told them. The great computer, Multivac, kept track—as it did of everything.

Multivac was the judge in this particular case, so coldly objective and purely upright that there was no need of prosecution or defense. There were only the accused, Simon Hines, and the evidence, which consisted, in part, of Ronald Bakst.

Bakst watched, of course. In his case, it was compulsory. He would rather it were not. In his 10th decade, he was showing signs of age and his rumpled hair was distinctly gray.

Noreen was not watching. She had said at the door, "If we had a friend left . . . " She paused, then added, "Which I doubt!" and left.

Bakst wondered if she would come back at all, but at the moment it didn't matter.

Isaac Asimov is the author of many science books, both fact and fiction. His most recent fiction is "Tales of the Black Widowers."

Hines had been an incredible idiot to attempt actual action—as though one could think of walking up to a Multivac outlet and smashing it, as though he didn't know a world-girdling computer, *the* world-girdling Computer with millions of robots at its command, could protect itself. And even if the outlet had been smashed, what would that have accomplished?

And Hines did it in Bakst's physical presence, too!

He was called, precisely on schedule: "Ronald Bakst will give evidence now."

Multivac's voice was beautiful, with a beauty that never quite vanished no matter how often it was heard. Its timbre was neither quite male nor, for that matter, female, and it spoke in whatever language its hearer understood best.

"I am ready to give evidence," Bakst said.

There was no way to say anything but what he had to say. Hines could not avoid conviction. In the days when Hines would have had to face his fellow human beings, he would have been convicted more quickly and less fairly—and would have been punished more crudely.

■

Fifteen days passed, days during which Bakst was quite alone. Physical aloneness was not a difficult thing to envisage in the world of Multivac. Hordes had died in the days of the great catastrophes; it had been the computers that had saved what was left and directed the recovery—and improved their own designs till all were merged into Multivac. Five million human beings were left on Earth to live in perfect comfort.

But those five million were scattered and the chances of one seeing another outside the immediate circle, except by design, were not great. No one was designing to see Bakst, not even by television.

For the time, Bakst could endure the isolation. He buried himself in his chosen way—which happened to be, these last 23 years, the designing of mathematical games. Every man and woman on Earth could develop a way of life to self-suit, provided always that Multivac, weighing all of human affairs with perfect skill, did not judge the chosen way to be subtractive to human happiness.

But what could be subtractive in mathematical games? It was purely abstract, pleased Bakst, harmed no one else.

He did not expect the isolation to continue. The Congress would not isolate him permanently without a trial—a different kind of trial from that which Hines had experienced, of course, one without Multivac's tyranny of absolute justice.

Still, he was relieved when it ended, and pleased that it was Noreen's coming back that ended it. She came trudging over the hill toward him and he started toward her, smiling. It had been a successful five-year period during which they had been together. Even the occasional meetings with her two children and two grandchildren had been pleasant.

He said, "Thank you for being back."

She said, "I'm not back." She looked tired. Her brown hair was windblown, her prominent cheeks a trifle rough and sunburned.

Bakst pressed the combination for a light lunch and coffee. He knew what he liked. She didn't stop him, and though she hesitated for a moment, she ate.

She said, "I've come to talk to you. The Congress sent me."

"The Congress!" he said. "Fourteen men and women. Self-appointed and helpless."

"You didn't think so when you were a member."

"I've grown older. I've learned."

"At least you've learned to betray your friends."

"There was no betrayal. Hines tried to damage Multivac; a foolish, impossible thing for him to try."

"You accused him."

"I had to. Multivac knew the facts without my accusation, and without my accusation, I would have been an accessory. Hines would not have gained, but I would have lost."

"Without a human witness, Multivac would have suspended sentence."

"Not in the case of an anti-Multivac act. This wasn't a case of illegal parenthood or life-work without permission. I couldn't take the chance."

"So you let Simon be deprived of all work permits for two years."

"He deserved it."

"A consoling thought. You may have lost the confidence of the Congress, but you have gained the confidence of Multivac."

"The confidence of Multivac is important in the world as it is," said Bakst seriously. He was suddenly conscious of not being as tall as Noreen.

She looked angry enough to strike him; her lips pressed whitely together. But then she had passed her 80th birthday—no longer young—and the habit of nonviolence was too ingrained. Except for fools like Hines.

"Is that all you have to say, then?" she asked.

"There could be a great deal to say. Have you forgotten? Have you all forgotten? Do you remember how it once was? Do you remember the 20th century? We live long now; we live securely now; we live happily now."

"We live worthlessly now."

"Do you want to go back to what the world was like once?"

Noreen shook her head violently. "Demon tales to frighten us. We have learned our lesson. With the help of Multivac we have come through, but we don't need that help any longer. Further help will soften us to death. Without Multivac, *we* will run the robots, *we* will direct the farms and mines and factories.

"How well?"

"Well enough. Better, with practice. We need the stimulation of it in any case, or we will all die."

Bakst said. "We have our work, Noreen; whatever work we choose."

"Whatever we choose, as long as it's unimportant, and even that can be taken away at will—as with Hines. And what's your work, Ron? Mathematical games? Drawing lines on paper? Choosing number combinations?"

Bakst's hand reached out *(Continued*

to her, almost pleadingly: "That can be important. It is not nonsense. Don't underestimate..." He paused, yearning to explain but not quite knowing how he could, safely. He said, "I'm working on some deep problems in combinatorial analysis based on gene patterns that can be used to . . ."

"...To amuse you and a few others. Yes, I've heard you talk about your games. You will decide how to move from A to B in a minimum number of steps and that will teach you how to go from womb to grave in a minimum number of risks and we will all thank Multivac as we do so."

She stood up. "Ron, you will be tried. I'm sure of it. *Our* trial. And you will be dropped. Multivac will protect you against physical harm, but you know it will not force us to see you, speak to you, or have anything to do with you. You will find that without the stimulation of human interaction, you will not be able to think—or to play your games. Good-by."

"Noreen! Wait!"

She turned at the door. "Of course, you will have Multivac. You can talk to Multivac, Ron."

He watched her dwindle as she walked down the road through the parklands kept green and ecologically healthy by the unobtrusive labors of quiet, single-minded robots one scarcely ever saw.

He thought: Yes, I will have to talk to Multivac.

■

Multivac had no particular home any longer. It was a global presence knit together by wire, optical fiber, and microwave. It had a brain divided into a hundred subsidiaries but acting as one. It had its outlets everywhere and no human being of the five million was far from one.

There was time for all of them, since Multivac could speak to all individually at the same time and not have to lift its mind from the greater problems that concerned it.

Multivac indifferently permitted talk of any kind, precisely because talk was unimportant. It was only acts that Multivac prevented, or punished.

Bakst had no illusions as to its strength. What was its incredible intricacy but a mathematical game that Bakst had come to understand over a decade ago? He knew the manner in which the connecting links ran from continent to continent in a huge network whose analysis could form the basis of a fascinating game. How do you arrange the network so that the flow of information never jams? How do you arrange the switching points? How to prove that no matter what the arrangement, there is always at least one point which, on disconnection . . . ?

Once Bakst had learned the game, he had dropped out of the Congress. What could they do but talk and of what use was that? Multivac indifferently permitted talk of any kind and in any depth, precisely because talk was unimportant. It was only acts that Multivac prevented, diverted, or punished.

And it was Hines's act that was bringing on the crisis; and before Bakst was ready for it, too.

Bakst had to hasten now, and he applied for an interview with Multivac without any degree of confidence in the outcome.

Questions could be asked of Multivac at any time. There were nearly a million outlets of the type that had withstood Hines's sudden attack into which, or near which, one could speak. Multivac would answer.

An *interview* was another matter. It required time; it required privacy; most of all it required Multivac's judgment that it was necessary. Although Multivac had capacities that not all the world's problems consumed, it had grown chary, somehow, of its time. Perhaps that was the result of its ever-continuing self-improvement. It was becoming constantly more aware of its own worth and less likely to bear trivalities with patience.

Bakst had to depend on Multivac's good will. His leaving of the Congress, all his actions since—even the bearing of evidence against Hines—had been to gain that good will. Surely it was the key to success in this world.

He would have to assume the good will. Having made the application, he at once traveled to the nearest substation by air. Nor did he merely send his image. He wanted to be there in person; somehow he felt his contact with Multivac would be closer in that way.

■

The room was almost as it might be if there were to be a human conference planned over closed multivision. For one flash-by moment, Bakst thought Multivac might assume an imaged human form and join him—the brain made flesh.

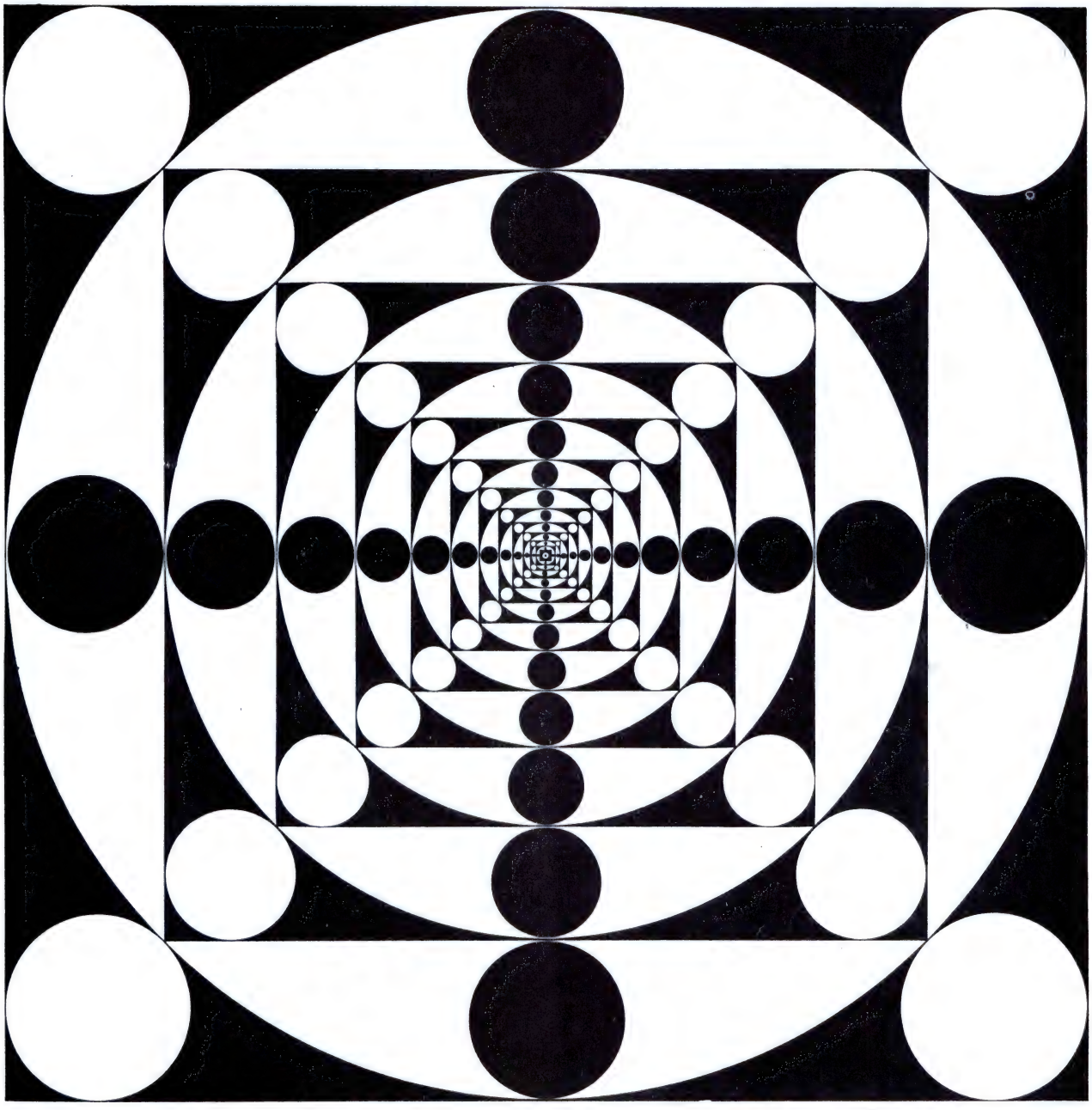
It did not, of course. There was the soft, whispering chuckle of Multivac's unceasing operations—something always evident in Multivac's presence—and over it, now, Multivac's voice.

It was not the usual voice of Multivac. It was a still, small voice, beautiful and insinuating, almost in his ear.

"Good day, Bakst. You are welcome. Your fellow human beings disapprove of you."

Multivac always comes to the point, thought Bakst. He said, "It does not matter, Multivac. What counts is that I accept your decisions as for the good of the human species. You were designed to do so in the primitive versions of yourself and . . ."

"...And my self-designs have continued this basic approach. If *you* understand this, why do so many human



beings fail to understand it? I have not yet completed the analysis of that phenomenon."

"I have come to you with a problem," said Bakst.

Multivac asked, "What is it?"

Bakst said, "I have spent a great deal of time on mathematical problems inspired by the study of genes and their combinations. I cannot find the necessary answers and home-computerization is of no help."

There was an odd clicking and Bakst could not repress a slight shiver at the sudden thought that Multivac might be avoiding a laugh. It was a touch of the human beyond anything even he was ready to accept. The voice was in his other ear and Multivac said:

"There are six billion different genes in the human cell. Each gene has an average of perhaps 50 variations in existence and uncounted numbers that have never been in existence. If we were to attempt to calculate all possible combinations, the mere listing of them at my fastest speed, if steadily continued, would, in the longest possible lifetime of the Universe, achieve but an infinitesimal fraction of the total."

Bakst said, "A complete listing is not needed. That is the point of my game. Some combinations are more probable than others and by building probability upon probability, we can cut the task enormously. It is in the manner of achieving this building of probability upon probability that I ask your help."

"It would still take a great deal of my time. How could I justify this to myself?"

Bakst hesitated. No use in trying a complicated selling job. With Multivac, a straight line was the shortest distance between two points.

He said: "An appropriate

gene combination might produce a human being more content to leave decisions to you, more willing to believe in your resolve to make men happy, more eager to *be* happy. I cannot find the proper combination, but you might, and with guided genetic engineering . . ."

"I see what you mean. It is . . . good. I will devote some time to it."

■

Bakst found it difficult to hitch into Noreen's private wave length. Three times the connection broke away. He was not surprised. In the last two months, there had been an increasing tendency for technology to slip in minor ways—never for long, never seriously — and he greeted each occasion with a somber pleasure.

This time it held. Noreen's face showed, holographically three-dimensional. It flickered a moment, but it held.

"I'm returning your call," said Bakst, dully impersonal.

"For a while it seemed impossible to get you," said Noreen. "Where have you been?"

"Not hiding. I'm here, in Denver."

"Why in Denver?"

"The world is my oyster, Noreen. I may go where I please."

Her face twitched a little. "And perhaps find it empty everywhere. We are going to try you, Ron."

"Now?"

"Now!"

"And here?"

"And here!"

Volumes of space flickered into different glitters on either side of Noreen, and further away, and behind. Bakst looked from side to side, counting. There were 14, six men, eight women. He knew every one of them. They had been good friends once, not so long ago.

To either side and beyond the simulacra was the wild background of Colorado on a pleasant summer day that was heading toward its end. There had been a city here once named Denver. The site still bore the name though it had been cleared, as most of the city sites had been. He could count 10 robots in sight, doing whatever it was robots did.

They were maintaining the ecology, he supposed. He knew no details, but Multivac did, and it kept 50 million robots all over the Earth in efficient order.

Behind Bakst was one of the converging grids of Multivac, almost like a small fortress of self-defense.

"Why now?" he asked. "And why here?"

Automatically, he turned to Eldred. She was the oldest of them and the one with authority — if a human being could be said to have authority.

Eldred's dark-brown face looked a little weary. The years showed, all six score of them, but her voice was firm and incisive. "Because we have the final fact now. Let Noreen tell you. She knows you best."

Bakst's eves shifted to Noreen. "Of what crime am I accused?"

"Let us play no games, Ron. There are no crimes under Multivac except to strike for freedom and it is a human crime that you have committed, no crime under Multivac. For that we will judge whether any human being alive wants your company any longer, wants to hear your voice, be aware of your presence, or respond to you in any way."

"Why am I threatened with isolation then?"

"You have betrayed all men."

"How?"

"Do you deny that you seek to breed mankind into subservience to Multivac."

"Ah!" Bakst folded his arms across his chest. "You found out quickly, but then you had only to ask Multivac."

Noreen asked, "Do you deny that you asked for help in the genetic engineering of a strain of humanity designed to accept slavery under Multivac without question?"

"I suggested the breeding of a more contented humanity. Is this a betrayal?"

Eldred intervened. She said, "We don't want your sophistry, Ron. We know it by heart. Don't tell us once again that Multivac cannot be withstood, that there is no use in struggling, that we have gained security. What you call security, the rest of us call slavery."

Bakst said, "Do you proceed now to judgment, or am I allowed a defense?"

"You heard Eldred," said Noreen. "We know your defense."

"We all heard Eldred," said Bakst, "but no one has heard *me*. What she says is my defense is not my defense."

There was a silence as the images glanced right and left at each other. Eldred said, "Speak!"

Bakst said, "I asked Multivac to help me solve a problem in the field of mathematical games. To gain its interest, I pointed out that the problem was modeled on gene combinations and that a solution might help in designing a gene combination that would leave man no worse off than he is now in any respect and yet breed into him a cheerful acceptance of Multivac's direction and acquiescence in its decisions."

"So we have said," said Eldred.

"It was only on those terms that Multivac would have accepted the task. Such a new breed is clearly desirable for mankind by Multivac's standards, and by Multivac's standards it must labor toward that. And the desirability of the end will lure it on to examine greater and greater complications of a problem whose endlessness is beyond what even it can handle. You all witness that."

Noreen said, "Witness what?"

"Haven't you had trouble reaching me? In the last two months, hasn't each of you noticed small troubles in what has always gone smoothly. You are silent. May I accept that as an affirmative?"

"If so, what then?"

Bakst said, "Multivac has been placing all its spare circuits on the problem. It

'Do you deny that you asked for help in the genetic engineering of a strain of humanity designed to accept slavery under Multivac without question?' 'I suggested the breeding of a more contented humanity. Is this a betrayal?'

has been slowly pushing the running of the world toward rather a skimpy minimum of its efforts, since nothing, by its own sense of ethics, must stand in the way of human happiness and there can be no greater increase in that happiness than to accept Multivac."

Noreen asked, "What does all this mean? There is still enough in Multivac to run the world—and us—and if this is done at less than full efficiency, that would only add temporary discomfort to our slavery. Only temporary, because it won't last long. Sooner or later, Multivac will decide the problem is insoluble, or will solve it; in either case, Multivac's distraction will end. In the latter case, slavery will become permanent and irrevocable."

"But for now Multivac is distracted," said Bakst, "and we can even talk like this — most dangerously — without its noticing. Yet I dare not risk doing so for long, so please understand me quickly.

"I have another mathematical game—the setting up of networks on the model of Multivac. I have been able to demonstrate that no matter how complicated and redundant the network is, there must be at least one place into which all the currents can funnel under particular circumstances. There will always be the fatal apoplectic stroke if that one place is interfered with since it will induce overloading elsewhere which will break down and induce overloading still elsewhere — and so on, indefinitely, till all breaks down."

"Well?"

"And this is the point. Why else have I come to Denver? And Multivac knows it, too, and this point is guarded electronically and robotically to the point where it cannot be penetrated."

"Well?"

"But Multivac is distracted, and Multivac trusts me. I have labored hard to gain that trust, at the cost of losing all of you, since only with trust is there the possibility of betrayal. If any of you tried to approach closely to Multivac, it might rouse itself even out of its present distraction. If Multivac were not distracted, it would not allow even me to approach. But Multivac *is* distracted, and it *is* I who am approaching!"

Bakst was moving toward the converging grid in a calm saunter and the 14 images, keyed to him, moved along as well. The soft susurrations of a busy Multivac center were all about them.

Bakst said, "Why attack an invulnerable opponent? Make him vulnerable first, and then . . ."

Bakst fought to stay calm, but it all depended on this now. Everything! With a sharp yank, he uncoupled a joint. If he had only had still more time to make more certain.

He was not stopped—and as he held his breath, he became aware of the ceasing of noise, the ending of whisper, the closing down of Multivac. If, in a moment, that soft noise did not return, then he had reached the right key point, and no recovery would be possible. If he were not suddenly the focus of approaching robots—

He turned in the continuing silence. The robots in the distance were working still. None were approaching.

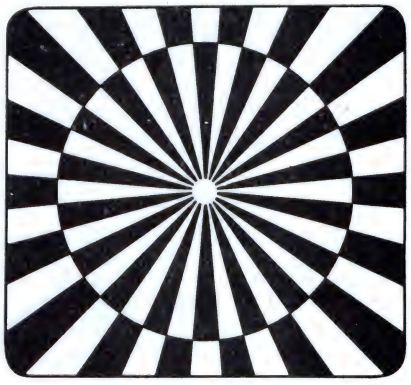
Before him, the images of the 14 men and women of Congress were still there and each seemed to be stupefied at the sudden, enormous thing that had happened.

Bakst said, "Multivac is shut down, burned out. It can't be rebuilt." He felt almost drunk at the sound of what he was saying. "I have worked toward this since I left you. When Hines attacked, I feared there might be other such efforts, that Multivac would double its guard, that even I . . . I had to work quickly . . . I wasn't sure . . ." He was gasping, but forced himself steady, and said solemnly: "I have given us our freedom."

And he paused, aware at last of the gathering weight of the silence. Fourteen images stared at him, without any of them offering a word in response.

Bakst said sharply, "You have talked of freedom. You *have* it!"

Then, uncertainly, he said, "Isn't that what you want?" ■



A new learning activity from Creative Computing . . . .

Surveys, The Census, and Privacy

by David H. Ahl

Every 10 years, the United States government takes a census of every person in the country. This serves a number of very useful purposes. First, it tells how many people there are in the country. Second, it gives data on living and income patterns and answers questions on whether the quality of life is improving, indicates the decline (or growth) of disadvantaged sectors of the population, and on economic growth. Also it gives valuable information on educational attainment. It also yields vital statistics on population mobility, mortality, birth rates, etc.

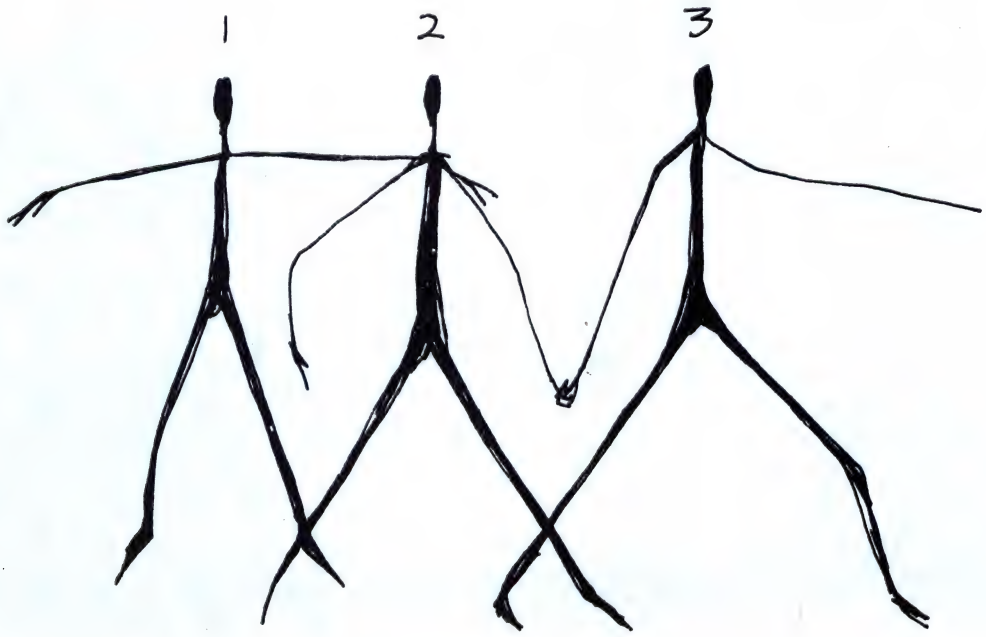
Private industry, various government bodies, colleges, and other groups also take surveys from time to time. Here are some examples of recent surveys:

- The Department of Transportation surveyed passengers on the NY-Washington Metroliner about passenger rail service.
- Educational Systems Research Institute surveyed the graduates of career education programs in 15 cities for the U. S. Office of Education.
- Ohio State University surveyed its students on a number of issues including the reaction to their black studies program.
- General Mills Corporation surveyed consumers about their preferences for various snack and cereal products.
- Consumer Mail Panels (for several insurance companies) surveyed a cross section of people involved in auto accidents to see how well their insurance claims were handled.

EXERCISE 1

Take a survey of the following items in class. Make a little table to put the results like this:

	Number of Students	Percent
A. Number of Children in Family		
1		
2		
3		
etc.		
B. Age		
13		
14		
15		
etc.		
C. Does mother work?		
Full time		
Part time		
No		
D. Number of letters in last name		
5 or fewer		
6, 7, or 8		
9, 10, or 11		
12 or more		
E. Rank the performance of the President		
Poor		
Fair		
Good		
Excellent		
F. Do you like raisin bran?		
Yes		
No		



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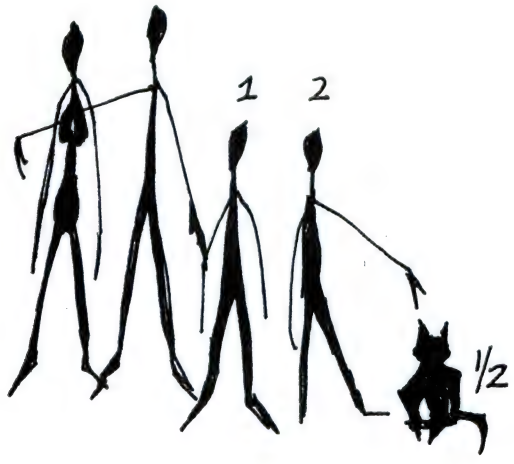
EXERCISE 2

Write a computer program to accept the responses to the questions in Exercise 5 for the members of the class. The program should then compute the percentages, and print a table similar to that above. Have the program "dump" the data at the end, i.e., print a list of each class member and their responses like this.

```
SALLY CARLSON          1 2 2  7 3 1
DAN BOSTICH            2 1 2  7 2 2
GENE WASHINGTON        1 2 1 10 2 1
```

etc.

Generally, the dump is done onto magnetic tape or punched cards so all the data does not have to be stored in the computer yet continues to be available for future use.



EXERCISE 3

Modify your program or write a new one that accepts input and analyses the value game responses for the whole class. (Do not have this program dump the individual responses at the end.) Discuss the tabular results in class. Does comparing your values with those of the class as a whole help clarify things for you? Do you tend to conform or be more of an individual? Do some of the results make you feel good? Are others embarrassing?

EXERCISE 4

Thinking now of the program in Exercise 3, would you want other members of the class to see your responses? If we were to do a dump, what should be done with it? Would you feel better if it was kept locked up by the teacher? Or would you rather see it burned? If it were destroyed and we decided later that we'd like to cross tabulate some results or add the results of two or three classes together to get a better overall average we wouldn't be able to. Then what?

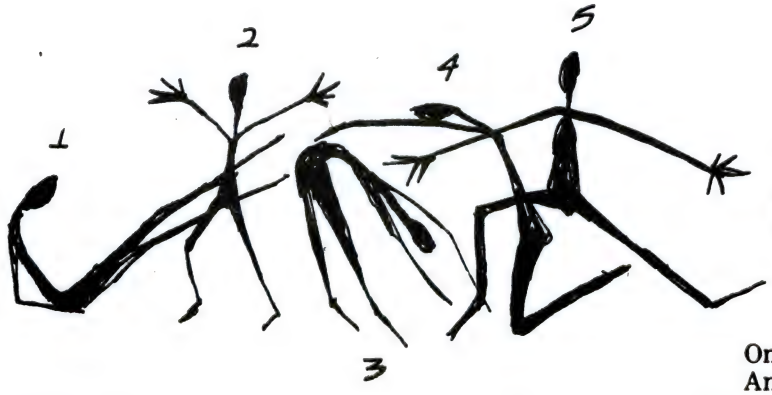
Discuss various solutions to this issue looking at their advantages and disadvantages. Think of them relative to the census, a cereal survey, and your credit data (for charge accounts and loans). Here are some possibilities:

1. Determine all possible analyses ever to be done with the data and do them. Then throw the raw data away.
2. Keep the raw data but throw away the name.
3. Keep the data on magnetic computer tape and keep the tapes locked up.
4. Keep the data in coded form on magnetic tape.
5. Appoint a committee of people who are using the data and those who are in the survey and let them decide the disposition.

Can you think of other possibilities?

EXERCISE 5

The following page is an excerpt from the summary and recommendations of the report, "Records, Computers, and the Rights of Citizens", from the HEW Secretary's Advisory Committee on Automated Personal Data Systems. It is directed at organizations collecting data for research purposes. Is it complete? Does it cover all possibilities? Is it too restrictive in places? Where?



THERE ARE NOW 3,000 DIFFERENT KINDS OF CREDIT CARDS IN USE

U.S. CREDIT BUREAUS HAVE ACCUMULATED LARGER FILES ABOUT INDIVIDUALS THAN THE COMBINED FILES OF THE F.B.I. AND THE C.I.A.

One credit bureau claims to have 45,000,000 Americans and Canadians in their files.

The following excerpt is taken from the summary and recommendations of the report, "Records, Computers and the Rights of Citizens," from the HEW Secretary's Advisory Committee on Automated Personal Data Systems (See Editorial, Page 3). Copies of the full report (DHEW (OS)73-94; GPO#1700-00116) may be ordered for $2.35 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Safeguard Requirements For Statistical-Reporting and Research Systems

I. GENERAL REQUIREMENTS

A. Any organization maintaining a record of personal data, which it does not maintain as part of an automated personal data system used exclusively for statistical reporting or research, shall make no transfer of any such data to another organization without the prior informed consent of the individual to whom the data pertain, if, as a consequence of the transfer, such data will become part of an automated personal data system that is not subject to these safeguard requirements or the safeguard requirements for administrative personal data systems.

B. Any organization maintaining an automated personal data system used exclusively for statistical reporting or research shall:

(1) Identify one person immediately responsible for the system, and make any other organizational arrangements that are necessary to assure continuing attention to the fulfillment of the safeguard requirements;

(2) Take affirmative action to inform each of its employees having any responsibility or function in the design, development, operation, or maintenance of the system, or the use of any data contained therein, about all the safeguard requirements and all the rules and procedures of the organization designed to assure compliance with them;

(3) Specify penalties to be applied to any employee who initiates or otherwise contributes to any disciplinary or other punitive action against any individual who brings to the attention of appropriate authorities, the press, or any member of the public, evidence of unfair information practice;

(4) Take reasonable precautions to protect data in the system from any anticipated threats or hazards to the security of the system;

(5) Make no transfer of individually identifiable personal data to another system without (i) specifying requirements for security of the data, including limitations on access thereto, and (ii) determining that the conditions of the transfer provide substantial assurance that those requirements and limitations will be observed—except in instances when each of the individuals about whom data are to be transferred has given his prior informed consent to the transfer; and

(6) Have the capacity to make fully documented data readily available for independent analysis.

II. PUBLIC NOTICE REQUIREMENT

Any organization maintaining an automated personal data system used exclusively for statistical reporting or research shall give public notice of the existence and character of its system once each year. Any organization maintaining more than one such system shall publish annual notices for all its systems simultaneously. Any organization proposing to establish a new system, or to enlarge an existing system, shall give public notice long enough in advance of the initiation or enlargement of the system to assure individuals who may be affected by its operation a reasonable opportunity to comment. The public notice shall specify:

(1) The name of the system;

(2) The nature and purpose(s) of the system;

(3) The categories and number of persons on whom data are (to be) maintained;

(4) The categories of data (to be) maintained, indicating which categories are (to be) stored in computer-accessible files;

(5) The organization's policies and practices regarding data storage, duration of retention of data, and disposal thereof;

(6) The categories of data sources;

(7) A description of all types of use (to be) made of data, indicating those involving computer-accessible files, and including all classes of users and the organizational relationships among them;

(8) The procedures whereby an individual, group, or organization can gain access to data for independent analysis;

(9) The title, name, and address of the person immediately responsible for the system;

(10) A statement of the system's provisions for data confidentiality and the legal basis for them.

III. RIGHTS OF INDIVIDUAL DATA SUBJECTS

Any organization maintaining an automated personal data system used exclusively for statistical reporting or research shall:

(1) Inform an individual asked to supply personal data for the system whether he is legally required, or may refuse, to supply the data requested, and also of any specific consequences for him, which are known to the organization, of providing or not providing such data;

(2) Assure that no use of individually identifiable data is made that is not within the stated purposes of the system as reasonably understood by the individual, unless the informed consent of the individual has been explicitly obtained;

(3) Assure that no data about an individual are made available from the system in response to a demand for data made by means of compulsory legal process, unless the individual to whom the data pertain (i) has been notified of the demand, and (ii) has been afforded full access to the data before they are made available in response to the demand.

* * *

In addition to the foregoing safeguard requirements for all automated personal data systems used exclusively for statistical reporting and research, we recommend that all personal data in such systems be protected by statute from compulsory disclosure in identifiable form. Federal legislation protecting against compulsory disclosure should include the following features:

- The data to be protected should be limited to those *used exclusively for statistical reporting or research*. Thus, the protection would apply to statistical-reporting and research data derived from administrative records, and kept apart from them, but not to the administrative records themselves.
- The protection should be limited to data *identifiable with, or traceable to, specific individuals*. When data are released in statistical form, reasonable precautions to protect against "statistical disclosure" should be considered to fulfill the obligation to disclose data that can be traced to specific individuals.
- The protection should be specific enough to qualify for non-disclosure under the Freedom of Information Act exemption for matters "specifically exempted from disclosure by statute." 5 U.S.C. 552(b)(3).
- The protection should be available for data in the custody of all statistical-reporting and research systems, whether supported by Federal funds or not.
- Either the data custodian or the individual about whom data are sought by legal process should be able to invoke the protection, but only the individual should be able to waive it.
- The Federal law should be controlling; no State statute should be taken to interfere with the protection it provides.

Puzzle: People and Cabins

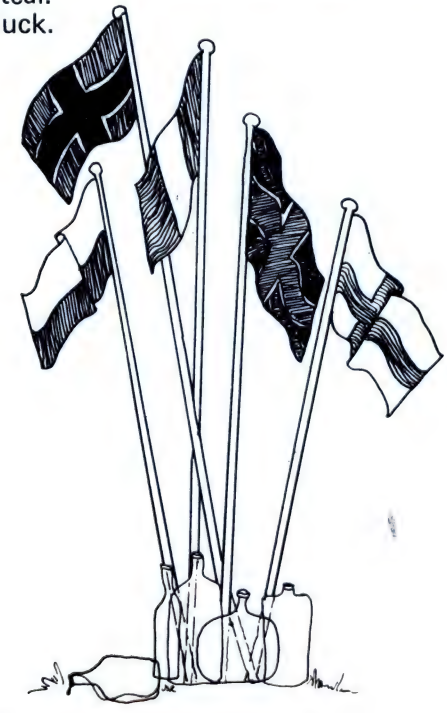
This one isn't easy. It could swallow up a day of your time, even a week. But it will take more than an hour.

The following 15 facts are all you need to solve it:

1. There are five hunting cabins on a lake. Each cabin is a different color, and is inhabited by a man of a different nationality, each drinking a different kind of liquor, firing a different brand of shotgun shell, and shooting a different duck.
2. The Englishman lives in the red cabin.
3. The Pole shoots only bluebills.
4. Bourbon is drunk in the green cabin.
5. The Finn drinks beer.
6. The green cabin is immediately to the right (your right) of the brown cabin.
7. The hunter who uses Winchester shells shoots mallards.
8. Remington shells are shot in the yellow cabin.
9. Brandy is drunk in the middle cabin.
10. The Norwegian lives in the first cabin on the left.
11. The man who buys Federal shells lives in the cabin next to the cabin of the man who shoots red heads.
12. Remington shells are used in the cabin next to the cabin where the canvasbacks are shot.
13. The hunter who fires Western shells drinks gin.
14. The Irishman loads up with Peters shells.
15. The Norwegian lives next to the blue cabin.

Your mission, should you decide to accept it, is to figure out who drinks the Scotch and who shoots the teal.

Good luck.



Thinkers' Corner

by Layman E. Allen © 1975

WORD PUZZLES

How many of the problems (a) through (f) below can you solve by forming a network of words that have exactly as many letters as the number listed as the GOAL? (Suppose that each symbol below is imprinted on a disc.)

To qualify as a network

(1) all sequences of discs across and down must be words,
(2) the words must have two or more letters and not be proper names,
(3) all of the discs in the REQUIRED column must be used,
(4) as many of the discs in PERMITTED as you wish may be used,
(5) at most one of the discs in RESOURCES may be used.

Example: The number of letters in the words of the network

C A T is 5: CAT TO
0 3 + 2 = 5.

The number in the network F A T is 3.

Problem	GOAL	REQUIRED	PERMITTED	RESOURCES
(a)	5	R F	L M P	C G J N U Y
(b)	7	A A	D T I	B E S V X Z
(c)	10	Q T N	I U M R	C G K O T W
(d)	10	E F R	J O O Q	B F H L S V
(e)	12	E R W	A K M S	D G K O T Y
(f)	19	A E R R T	A C L N O S	B F M R U W

Some Suggested Answers (frequently there are others):

(a) M FRY (b) I A SAT (c) QUIT ON

(d) SO FOR E (e) MOW ARE (f) A ACORN SURE T

If you enjoy this kind of puzzle, you may like playing ON–WORDS: The Game of Word Structures. Free information about this and other instructional games is available upon request from THE FOUNDATION FOR THE ENHANCEMENT OF HUMAN INTELLIGENCE, 1900-W Packard Rd., Ann Arbor, MI 48104.

A new learning activity from Creative Computing . . . .

Reading, Writing, and Computing

Walter Koetke
Lexington High School, Massachusetts

Problems Column Editor: Walter Koetke, Math Dept., Lexington High School, Lexington, MA 02173. Please send solutions and suggestions for problems directly to Mr. Koetke.

When Alex was admitted to Hopeful Hospital he knew he was very ill. After a thorough examination Dr. Frank concluded that Alex had a severe case of sleepitis, and that the proper treatment was lots of activity and exercise. Because Hopeful Hospital was very modern and up-to-date, the medical facilities included a computer to assist in the diagnosis and treatment of unusual illnesses. Dr. Frank entered Alex's symptoms into the computer, and the computer concluded that Alex had a severe case of exhaustitis. The computer also indicated that the proper treatment for exhaustitis was no activity, no exercise and lots of sleep. Dr. Frank considered his original diagnosis and the computer diagnosis, then decided to go along with the computer. The doctor prescribed no activity, no exercise and lots of sleep. Alex died one week after beginning the prescribed treatment. After his death, a group of doctors re-examined Alex's records and demonstrated that Alex actually had sleepitis, and that the prescription of no activity, no exercise and lots of sleep was largely responsible for his death.

Who should be blamed for Alex's death?

a) The computer — for making an incorrect diagnosis
b) The programmer — because the computer's incorrect diagnosis was probably a programming error
c) Dr. Frank — for making an incorrect diagnosis
d) Alex — for getting sick in the first place
e) No one — we all have to go sometime

If you answered a or b, or even gave serious consideration to answering a or b, then your computer literacy is indeed open to question. An elementary school education is inadequate if students leave without some idea of what computers can and cannot do. Society's use of computers is so extensive that even school dropouts are likely to use and certain to be affected by computers. Clearly then, the need for schools to carefully assess their efforts toward computer literacy of all students is essential.

If you need some support when you attempt to stir whatever is bogging down the implementation of computer literacy in your school, town or what-have-you, consider the following:

Dr. Arthur W. Luehrmann of Dartmouth College presented a paper titled "Should the Computer Teach the Student, or Vice Versa?" at the AFIPS 1972 Spring Joint Computer Conference. In this truly classic, penetrating paper Luehrmann raises questions such as "how much longer will a computer illiterate be considered educated? How long will he be considered employable and for what jobs . . ." Luehrmann's article inspired the title of this one — for developing skills in reading, writing and computing should now be the fundamental objective of education.

As you are probably aware, the NAEP (National Assessment of Educational Progress) conducted an extensive program in 1972-73 to determine the nature and effectiveness of mathematics education in the United States. In 1977-78, the NAEP will again assess the state of mathematics education — but something new will be added.

At that time they will also separately assess the nature and effectiveness of computer literacy education. How well will the students of your school and your town reflect a basic knowledge of computer literacy?

Computer literacy can not only be profitable, but it also might record your name for posterity. Several students at the California Institute of Technology recently used a computer to help generate their entries for a sweepstakes type of contest being run by the McDonald's Corp. The students not only won first prize, a car — not a pile of hamburgers, but also won a large percentage of all the other prizes. While McDonald's was objecting and claiming that the students took unfair advantage of all other contestants, their rival, Burger King, was presenting CIT with a scholarship in the name of the student who originated the idea.

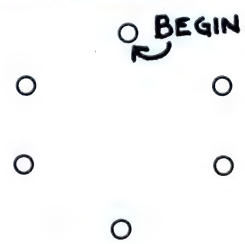
Since one of the primary purposes of this column is to suggest interesting problems, let's redirect our attention in that direction. Three of the following four problems are for those "getting started." Finding examples other than the very standard ones can be time consuming, particularly for teachers who are developing entire computer related units. Perhaps these will help.

1. Writing a program that generates or tests for prime numbers is a very good standard example for those learning to program. Usually, however, it is an end in itself. This problem is intended to provide an application for a prime testing algorithm.

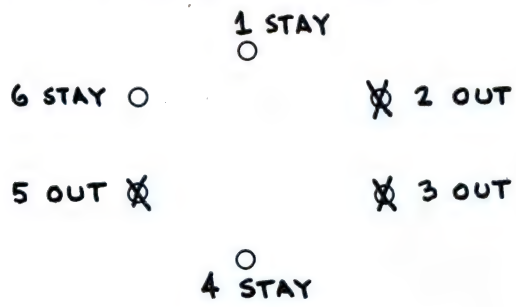
Suppose that k people are standing in a circle. After choosing one person to begin, the people count-off in a clockwise direction around the circle. If a person counts-off with a prime number he must leave the circle. The winner is the last person who remains.

Consider one example, say k = 6.

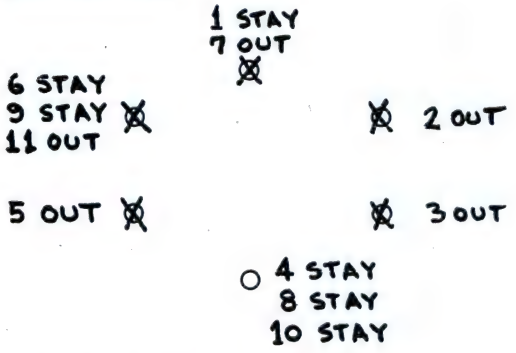
Then the people appear as



The initial counting process would yield:



And continuing:



Thus the fourth player is the winner.

The problem is to make a two-column table containing k and the player who would win for that value of k. Can you predict the player who wins for any given k?

2. The second problem can be rephrased in many different ways, all of which revolve about the question "Is each positive integer 1 through n a divisor of some integer that contains only the digits one and zero?" For example:

1 is a divisor of 1
2 is a divisor of 10
3 is a divisor of 111
4 is a divisor of 100
5 is a divisor of 10
6 is a divisor of 1110
and so forth.

If you have an answer and can prove yourself right, send me your answer in care of Creative Computing. I haven't yet seen a valid proof of an answer. Writing a program to determine the dividend for a given divisor is apt to raise several ideas worth examining — and it's only a division problem.

3. One very standard, likely boring example for new programmers who are also studying algebra is often that of the quadratic formula. A very clever way of making the same points as well as a host of more interesting ones was first presented to the author at an NCTM (National Council of Teachers of Mathematics) workshop conducted by Helen Hughes. Given the quadratic equation $Ax^2 + Bx + C = 0$, where A, B and C are integers such that $1 \leq A \leq 10$, $0 \leq B \leq 10$, and $0 \leq C \leq 10$, write a program that will find the probability that

a) the roots will be imaginary
b) the roots will be rational and equal
c) the roots will be rational but unequal
d) the roots will be irrational.

How are these probabilities affected by varying the limiting values of A, B and C?

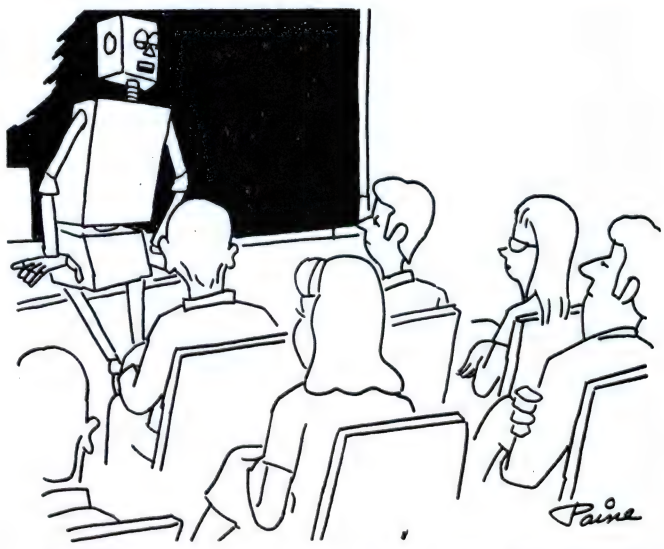
4. The final problem isn't computer related at all. In fact, it's not even going to help you get started at anything. Actually, it might finish age problems altogether. The next time you're asked to solve a problem about Dick being four years older than Fred was last Thursday, etc., pull this out of your pocket.

Ten years from now Tim will be twice as old as Jane was when Mary was nine times as old as Tim. Eight years ago, Mary was half as old as Jane will be when Jane is one year older than Tim will be at the time when Mary will be five times as old as Tim will be two years from now. When Tim was one year old, Mary was three years older than Tim will be when Jane is three times as old as Mary was six years before the time when Jane was half as old as Tim will be when Mary will be ten years older than Mary was when Jane was one-third as old as Tim will be when Mary will be three times as old as she was when Jane was born.

How old are they now?

I'm really not sure of the source of this timeless gem. A student gave it to me several years ago, and memory suggests he reported seeing it in an issue of the American Mathematical Monthly. At any rate, it might provide those who assign age problems a few moments to reconsider their usefulness.

The problem of Mutab, Neba and Sogal presented in the May - June issue has been resolved. The first correct solution was submitted by Charles Kluefil of Glen Oaks, New York, who reported that the chance of survival for Mutab is 30%, for Neda is 17-7/9%, and for Sogal is 52-2/9%. Unfortunately, the citizens of Aedi are still searching for a new leader. No solutions were received that qualified the sender as the new president.



"Today's topic of discussion will be, The Dehumanizing of Education"

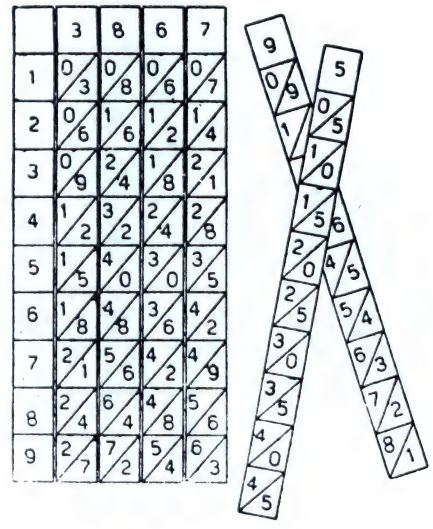
TECHNOLOGY... DOOMSDAY FOR INDIVIDUALISM?

A learning activity from Creative Computing....

Reprinted with permission from *Zephrus: DeSchool Primer* No. 4. (The entire DeSchool Primer series of 12 idea-crammed activity newspapers is outstanding. Most cost between $1.50 and $4.00 and are worth every penny. Write for a descriptive flyer to Ron Jones, Zephrus Education Exchange, 1201 Stanyan, San Francisco, CA 94117.)

OPTIMIST: The computer is our greatest hope for survival as individuals in a multi-billion person society, with all the institutions needed to keep that society going. What all this technical advance does, really, is keep us all from running into one another so we can act as individuals. Otherwise, it would have to be like the army -- with everyone in ranks.

PESSIMIST: That's where it is. All this technology and the changes it has brought on have made the contributions of individuals less and less important, and organized efforts more important. Who had a greater feeling of individual accomplishment -- Magellan sailing across the Pacific or the first men on the moon?



	3	8	6	7
1	03	08	06	07
2	06	16	12	14
3	09	24	18	21
4	12	32	24	28
5	15	40	30	35
6	18	48	36	42
7	21	56	42	49
8	24	64	48	56
9	27	72	54	63

PESSIMIST: No matter what you say, we live in a mass society. Both government and business seem to be trying to reduce us to organization people because we fit their computer programs better. Our self-image and sense of worth go down with each new technological advance.

OPTIMIST: Our higher level of education lets us learn new skills and develop our potential to the fullest. We have much more feeling of individualism than 19th century factory workers or farmers. The demands made by minorities show how much higher is our sense of individual worth than before.

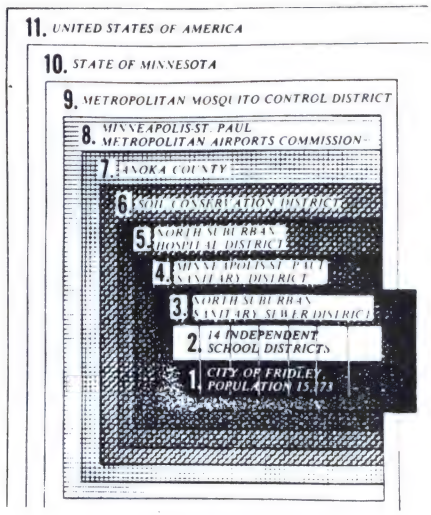
732-5168 Young Robyn 3369 Louis Rd PA 328-3476
493-3188 Young Ron D 23300 Eastbrk Av Ls Alts 941-6347
325-0417 Young Ronald J 768 Calla Dr Sunyvl 735-8482
734-4171 Young Ronald S 3830 Magnolia Dr PA 493-4040
Young Ronald W 200 E Dana M Vw 961-4850
736-7744 Young Rosalie 411 Hamltn Av Mnlo Pk 323-2935
969-9894 Young Roy 47 Eldora Dr M Vw 967-0750
326-2377 Young Russell 627 S n Juan Dr Sunyvl 732-9583
967-8262 Young Russell A 1613 Waxwing Av Sunyvl .. 246-6908
948-4050 Young Ruth H 185 E Homestd Rd Sunyvl 735-0388
324-2353 Young S E 228 Alvarado Av Ls Alts 941-2954
245-6427 Young S I 1220 Lawrnce Expresswy Sunyvl .. 734-4839
321-0498 Young S W 280 Easy M Vw 969-3309
323-7662 Young Sally C 345 Arbor Rd Mnlo Pk 322-8570
326-3566 Young Saml L 10955 Stonebrook Dr LAH ... 941-0571
327-6440 Young Sandra 707 Salvatierra SU 321-9354
964-9767 Young Set Mayfld Mall M Vw 961-2110
948-2080 Young Snoder 1367 Carltn Av Mnlo Pk 325-6032
739-7942 Young Steven P 325 Collge Av PA 326-7907
961-9425 Young Thos F 618-17th Av Mnlo Pk 322-6940
325-4155 Young Tim 26655 Laurel Ln LAH 941-3820
941-4354 Young V J 200 E Dana M Vw 964-1669
245-8554 **YOUNG VILLAGERS**
252 Main Ls Alts 948-2856
322-9297 Young W Haviland 808 Sevely Dr M Vw 968-0310
321-4712 Young Walter R 289 Avalon Dr Ls Alts 948-3634
854-4278 Young Warren T 1071 Embarcadero Rd PA . 321-1328
323-6286 Young Wayne 663 Yosemite Av M Vw 968-1398
327-5812 Young William A III
245-2282 2280 Sharon Rd Mnlo Pk . 854-1840
851-7859 Young Wm C 1097 Colton Av Sunyvl 734-8280
322-2017 Young Wm H 2505 Katrina Wy M Vw 969-2992
967-2056 Young Wm H 1043 Pilinut Ct Sunyvl 739-4928
732-6658 Young Wm M 26880 St Francis Rd LAH 948-4656
327-5448 Young Wm N 671 Milvrtn Rd Ls Alts 948-4777
734-1709 Young Wilma 971 Runnymde EPA 322-1715
851-2409 Young World Of Dance & Pre-School
948-4121 See California Young World
322-8273 Youngberg Donald R 831 Shetlnd Pl Sunyvl. 257-3406
968-8486 Youngberg Edwin S Mrs
961-3514 259 Verano Dr Ls Alts. 948-5933
493-6906 Youngberg Robt A 2671 Ross Rd PA 326-5634
967-6699 Youngberg Robt S 711 Portal Pl PA 327-8123
326-3404 Youngblood Bobby L 3911 Fair Oks Av Mnlo Pk 366-9756
321-8292 Youngblutt S P 1591 Dennis Ln M Vw 968-6465
969-2700 Youngdahl Geo O 867 Bremrtn Dr Sunyvl 739-9152
967-4272 Youngdale Ralph N 471 Los Ninos Wy Ls Alts. 948-7548
322-9741 Younge Rob Robl Hl SU. 328-8578
245-8044 Younger Bob 620 Iris Av Sunyvl. 736-1771
322-3908 Younger Sammy 1370 Norman Dr S Clara .. 736-3659

OPTIMIST: Makes it child's play to communicate with just about anyone, anywhere. Fosters individual growth.

PESSIMIST: Invasion of privacy. Lays me open to sales pitches, junk mail, and bugging. Ends up by destroying me.

PESSIMIST: Everyone today feels almost drowned in a sea of bigger and bigger government and business. They operate as if no one personally existed -- we're just voters, citizens, and consumers en masse.

OPTIMIST: Government and business look more powerful than ever, but they're more afraid of us than ever, because we're better educated and demand more. Look how they rely on polls, and have had to go to advertising to make people like them. We can get to them more easily than before.


11. UNITED STATES OF AMERICA
10. STATE OF MINNESOTA
9. METROPOLITAN MOSQUITO CONTROL DISTRICT
8. MINNEAPOLIS-ST. PAUL METROPOLITAN AIRPORTS COMMISSION
7. ANOKA COUNTY
6. SOIL CONSERVATION DISTRICT
5. NORTH SUBURBAN HOSPITAL DISTRICT
4. MINNEAPOLIS-ST. PAUL SANITARY DISTRICT
3. NORTH SUBURBAN SANITARY SEWER DISTRICT
2. 14 INDEPENDENT SCHOOL DISTRICTS
1. CITY OF FRIDLEY, POPULATION 15,173

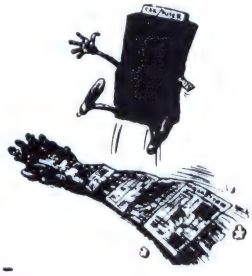
CLASSES FOR ADULTS

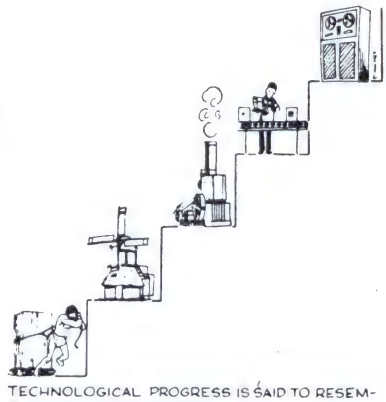
Begin September 11, 1973

SANTA CRUZ ADULT SCHOOL
350 Taylor Street
Santa Cruz, Ca. 95060

OPTIMIST: Today the government tries to provide everyone with education, health care, cultural development, housing, keeping the economy on track, and promoting technological advances. This frees people from worries they used to have.

PESSIMIST: But the price is that experts and faceless bureaucrats run these things, and act as if they know everything and are doing us a favor. We're less free than ever before.





TECHNOLOGICAL PROGRESS IS SAID TO RESEMBLE A FLIGHT OF STAIRS.

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
SOCIAL SECURITY ADMINISTRATION

YOUR SOCIAL SECURITY CARD

WHAT TO DO WITH YOUR CARD

- SIGN YOUR NAME on both cards.
- REMOVE THE TOP CARD and carry it in your wallet or purse, or keep it where it will be handy.
- LEAVE THE BOTTOM STUB attached to this holder and keep it with your other important papers such as birth certificate, insurance policies, etc.

OPTIMIST: I don't have to worry about my old age or getting sick. I'm free to develop in my own way.

PESSIMIST: I'm a number, a statistic. That's the way the government treats you. And they use all my salary and job information to manipulate me.

PESSIMIST: Before all this technology advance, people were free of experts, bureaucrats, big government, and big business. And they had privacy; they could do anything.

OPTIMIST: They sure did -- nobody cared if they were ignorant, starved, got sick, or died -- in privacy. Education, social care, and health need information to be efficient -- and it is an invasion of that old-fashioned privacy to get extensive and accurate information.

Your Own Computer?

by David H. Ahl

A number of people have asked me lately about computers in the home and about building your own. Somehow the two subjects seem to go hand-in-hand, probably because of an increasing number of low-priced computer kits on the market obviously aimed at the home hobbyist. In my mind, having your own computer at home and building your own are two entirely different animals.

A computer in the home is not like a ham radio rig or model railroad in which half of the enjoyment comes from the building. A computer is more like a TV set; 97% of the households in the U. S. have one, but most are not from Heathkit. A computer is, of course, much more than a TV – it provides education, recreation, and even utility.

You may find the following analogy chart useful to decide where you fit in the computer spectrum.

1. Use application programs	Drive a car (90% of population)
2. Program computer using high-level language (BASIC, FORTRAN, etc.)	Change oil, do tune-up (20%)
3. Computer science – machine languages, compilers, etc.	Auto mechanic – tear down and rebuild engine (1/4%)
4. Build your own computer from kit or plans	Build a dune buggy or dragster (0.1%)
5. Design and build your own computer	Design and build an efficient electric vehicle (0.001%)

In future issues of *Creative Computing,* we will report on No. 4, in particular, building an Altair 8800 computer kit (yes, I have previously built an HO model railroad, hi-fi components, and even a dune buggy). We'll also have some in-depth discussion on Nos. 1, 2, and 3 – that is, just what do you do with a home computer other than play games, and also where do you get one if you don't build it yourself?

Lies, Lies, Lies

Every once in a while I get a letter from a reader that makes me wonder whether you readers really believe everything you read in *Creative.* What am I saying? That there are falsehoods in *Creative*? That there are errors? That the truth is blemished? In a word, yes! And sometimes even deliberately!

The reason for this blasphemy is simply this: along with the best in computer activities, articles and other goodies, I happen to believe that we also have an obligation to do as much as possible in the way of bringing you an objective, multi-faceted, interesting, mind-expanding, broadening view of the world. And this is a world that contains people and ideas that are sometimes in conflict with one another, (not war, now) but what you might call cognitive dissonance. If we run an article which proclaims "there is no such thing as randomness," I don't really care if you believe it or not, but rather that it is a provocative idea that makes you think, or evaluate, or ponder, or wonder. That's what it's all about, folks – thinking and stretching your mind in order to create new ideas and make better use of the old ones.

And, incidentally, to have fun while you're at it!

–DHA

Introducing Computer Recreations Corp.

by Trish Todd and Scott Guthery

Last year Americans spent over $50 billion on recreation. And billions more on home entertainment – television sets, radios, stereos, quadraphonic sound systems, tape recorders and home movie and video tape equipment.

This is no passing fancy. We live in an age of increasing leisure time. More people have more time to do more things with more money than ever before.

We live in an age of advancing technology, too. And when the consuming public seems ready for a new innovation, the technology always seems to be there, ready to meet that need. Witness the booming electronic calculator market.

We also live in an age of shortages – of energy, of raw materials. And the recent gasoline shortage made people suddenly aware of the need to search out new sources of entertainment and recreation. Closer to home, or at home. Reports from the travel and entertainment industries indicate that this awareness remained, even after the gas returned.

We live, as well, in an age of computers. Only up to now the computer has seemed a sort of enemy to many of us and at best a friend only to the specialist. To the average consumer/citizen/worker the computer is as foreign as the Crab Nebula.

Fear of the unknown, of course, is understandable. But anyone who has witnessed the average child adapt to the computer environment knows how short lived fear of computers can be. And how soon the computer becomes a friend.

Which brings us to COMPUTER RECREATIONS, a company formed to bring a wide (and friendly) selection of computer games into subscribers' homes through a special home terminal. This terminal resembles a typewriter with a cradle for the customer's telephone headset and is connected to his home television. In dialing a special number, the player is connected with the Computer Recreations WATS line, and he enters the "Game Parlor."

The player is then given several options. He may ask what games are available, ask for game rules, inquire who is in the "Game Parlor" or watch another game that is in progress. The game possibilities include chess, golf, Monopoly, football, Space War, Solataire, Blackjack, and many others. The participants may use an alias while competing with other subscribers; their faces are never seen. Computer Recreations is also involved in simulating urban planning, management decision-making, and political models. The possibilities will be constantly expanding because of a built-in market research program.

The system is fairly expensive today although it is within the financial reach of the affluent middle class; however, the technology exists to develop a terminal within the reach of almost everyone. (DEC, RCA, and others are at work on very low cost terminals today.)

Many Americans tend to think of computers as impersonal machines which are gradually changing the spontaniety of human life into a dehumanized number system. Not so, says Computer Recreations, and they aim to prove their point. For more information, write Scott Guthery, President, Computer Recreations, P. O. Box F Cliffwood, NJ 07721.

COMPLEAT COMPUTER CATALOGUE

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

BOOKS AND BOOKLETS

TOWARD UNDERSTANDING THE SOCIAL IMPACT OF COMPUTERS

This very comprehensive 136-page book by Roy Amara is the distillation of the thoughts of 60 participants in four workshops held by the Institute for the Future. The principal message is that a real urgency exists to systematically understand how computers affect the decisions we make, the goods and services we produce, and the world we perceive. Specific topics discussed in-depth include: 1. Computer modeling and simulation as an aid to decision making, 2. Computers and financial processes, 3. Computer perceptions, attitudes, literacy, 4. Computers and individual access. A fifth could be added, "where do we go from here?" $10 to institutions, $7.50 to individuals and schools.

Institute for the Future, ATTN: Judy Flathman, 2740 Sand Hill Road, Menlo Park, CA 94025.

COMPUTERS IN EDUCATION

This ambitious little booklet (48 pp text, 14 pp appendices) boldly attempts to cover in three parts: How Computers Work, Administrative Uses of Computers, and Educational Uses of Computers. Indeed in the reading time of one hour, a person will get from this booklet a clear, concise and amazingly complete view of the computer in education. Last known price $1.00.

Computer Services, Province of Manitoba Dept. of Education, 103 Water Ave., Winnipeg, MB, R3C OJ2, Canada.

COMPUTERS BOOKLET

A 94-page booklet for 40 cents? Why, it's even difficult to get 94 sheets of blank paper for 40 cents. And yet here is one of the best basic descriptive books on computer hardware. It covers the birth of computers from the abacus and Babbage up to the present day, the anatomy of a computer including simplified explanations of some very sophisticated hardware, and finally some speculation about what's coming in the way of applications and large networks. The booklet simply titled *Computers* is written by William Corliss and published by the AEC, sorry ERDA. This one is a must. 40¢ each, even less in quantity. (Many other booklets are also available from ERDA; we recommend three: *Cryogenics, Teleoperators* and *Lasers.* Send $1.60 for all four.)

U.S. Energy Research and Development Administration, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

POPULATION AND FOOD

There are two interrelated and indisputable facts which many people have failed to comprehend: 1) world food production cannot keep pace with world population growth (not even with computer planning, miracle fertilizers, or plankton harvests from the ocean) and 2) "family planning" or new contraceptives cannot and will not, in the foreseeable future, check population growth. People are clearly looking for a miracle solution since the alternative, of course, is triage. Every person in the world, has an obligation to learn more about this situation which can only be described as a crisis. Send for a copy of the "Declaration on Population and Food" and a subscription to "The Other Side." Both free.

The Environmental Fund, 1302 Eighteenth St., N.W., Washington, DC 20036.

3 IFIP BOOKLETS

Three booklets have been produced between 1971 and '74 by various working groups of the International Federation for Information Processing.

Computer Education for Teachers in Secondary Schools – An Outline Guide is for those who are planning courses for the training of teachers. It gives suggestions for the content of courses although the information is of a very general nature. Includes 3 brief but excellent pages on methodology. 75¢.

Computer Education for Teachers in Secondary Schools – Aims and Objectives in Teacher Training. Booklet shows how society and education is changing and discusses the role of the computer in modern education. Lists brief outlines for seven courses. 75¢.

The Use of the Computer in Teaching and Learning. Describes ways of using the computer in education, the rationale and benefits. Discusses the necessary factors for a successful program – key people, instructional material development, facilities, and hardware acquisition. Depth of coverage is sparse (booklet has only 16 pages of text). $1.50.

AFIPS Press, 210 Summit Ave., Montvale, NJ 07645.

SMALL PRESS MATERIALS

Edcentric, Haiku Magazine, Tzaddikim, Feminist Art Journal, Fiction, Roar, Nitty Gritty, Blue Pig, Algol, Maybe, and *Quest* are just 11 of the approximately 1800(!) little magazines and small presses listed and described in the 1975-76 International Directory of Little Magazines and Small Presses. If you want a different view of the world, sometimes strange, sometimes ecstatic, but always refreshing, get this directory and send for sample copies of 10 or 20 little magazines. Directory $5.95 plus 50¢ postage.

Dustbooks, P.O. Box 1056, Paradise, CA 95969.

COMPUTER OUTPUT MICROFILM COMICS

A clever comic book with Super Rex and Clark Trent explains how-tos and benefits of computer output microfilm. 25¢.

Memorex Corp., San Tomas at Central Expressway, Santa Clara, CA 95052.

BRAINSTORMING, CREATIVITY

Practical exercises and guides to brainstorming, creative thinking, designing objectives, getting people involved in this book by Donkoberg and Jim Bagnall. The title is a jaw-breaker, *The Universal Traveler: A Soft-System Guide to Creativity, Problem Solving and the Process of Reaching Goals.* Price unknown.

William Kaufmann, Inc., One First St., Los Altos, CA 94022.

MAGAZINES, JOURNALS, NEWSLETTERS

THEORETICAL COMPUTER SCIENCE

A new quarterly journal covering theoretical automata, semantics of programming languages, the study of algorithms and their complexity, and the nature of computation. Mathematical and abstract in spirit but motivated by problems of practical computation. $43.95 per year, sample copy free.

North-Holland Publishing Co., c/o American Elsevier Publishing Co., 52 Vanderbilt Ave., New York, NY 10017.

HP EDUCATIONAL NEWSLETTER

An outstanding 8-times a year newsletter produced for users of Hewlett Packard computers in education. Naturally it is oriented to software which runs on HP machines, mostly BASIC. A portion of each issue is generally devoted to user application (success) stories. About 40% or 50% of each issue presents instructional applications and activities, sometimes on one special focus topic, sometimes on many. Shorter sections include book reviews (genuine reviews, not publisher press releases), letters, announcements, and a calendar of events. Free to HP users. $6 per year to others.

HP Educational Users Group, 11000 Wolfe Road, Cupertino, CA 95014.

SIGCUE BULLETIN

This is the official publication for the 1,300 member Special Interest Group on Computer Uses in Education (SIGCUE) of the Association for Computing Machinery (ACM). An excellent source of information on using computers in college instruction. Contains brief technical articles, interviews, conference reports, book reviews, and calendar of events. Four issues per year. $6/year ($4 for ACM members).

Assn. for Computing Machinery, 1133 Avenue of the Americas, New York, NY 10036.

THE AMERICAN SYSTEM

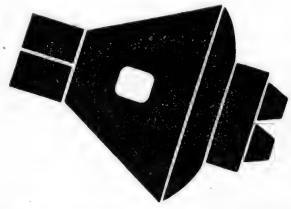
For businessmen, *Fortune* is practically required reading; for other people, ho hum. However, the April 1975 "Special Bicentennial Issue: The American System" should be required reading for everyone. An article by Max Ways discusses how the System quickens and guides Americans toward higher goals and harder challenges, but then how each triumph brings its swarm of troubles. Daniel Bell discusses the danger of people demanding equality of result and not just equality of opportunity, and speculates that these demands could well overload our political system. Two other articles examine our battered educational system and scientific system. Can both regain their vitality of 20 years ago? And at what cost? Another article discusses the new generation of young Americans, their ethics, responsibility, and the fact that they expect more from the System than any previous generation. This issue of *Fortune* deserves a place in your personal "search for freedom and self-fulfillment" (J.F. Kennedy). *Fortune,* April 1975, $2.00.

Fortune, 541 North Fairbanks Court, Chicago, IL 60611.

FUTURE REPORT

This 18-issues-per-year newsletter contains scores of capsule reports in each issue from one line to a few paragraphs on emerging future trends. Generally a number of computer-related items in each issue. The reports as a whole make a fascinating mosaic of what society is likely to be in the near future. Covers subjects from space travel to energy, medical practice to courtrooms, and environment to music. Free Perpetual Calendar of the Future with one-year subscription. $36/year. Sample copy free.

Foundation for the Future, P.O. Box 2001, MIT Branch P.O., Cambridge, MA 02139.



DO YOU SUPPORT TECHNOLOGY?

If you read *Creative Computing* regularly, chances are you have a warm spot in your heart for science and technology. Many other people, particularly students and educators, with similar views have joined the Federation of Americans Supporting Science and Technology. Recent issues of FAAST News have covered a variety of topics: Aerospace (space shuttle, remote sensing, "Cosmic/Charisma", the OSCAR satellite); Biomedical (fetal research, continuing medical education); Energy (nuclear fuels, natural gas issues, cryogenic energy, ERDA); Environment; and various political activities. FAAST membership (includes bi-monthly *FAAST News*) $5.00.

FAAST, 1785 Massachusetts Ave., N.W., Washington, DC 20036.

PERSONAL PRIVACY VS. THE CORPORATE COMPUTER

Americans have long abhorred the spector of a faceless, bureaucratic Big Brother. As computerized personal data systems have grown more and more sophisticated, many people have become concerned about the threat these systems pose to individual privacy. Recently some state and federal regulations have been passed to counter the threat and more are in the offing. But the cost of complying with them will be very high. In an article in *Harvard Business Review* (Vol. 53, No. 2, Mar-Apr 1975), Robert Goldstein and Richard Nolan discuss the impact of the new privacy laws on five active personal data systems – consumer credit, health, personnel, insurance, and law enforcement. They also suggest several steps that organizations must take to adjust to the new environment. Reprints of "Personal Privacy vs. the Corporate Computer" cost $3.00 each for 1 to 5 or 50¢ each for 6 or more (why get 1 when you can get 6 for the same price?).

Reprint Service, *Harvard Business Review,* Boston, MA 02163.

MAJOR ROLES FOR MINICOMPUTERS IN BUSINESS

Managers have known for several years that the effectiveness of a computer system is proportional to the square of its cost, i.e., pay twice as much and get four times the performance. Because of this and because there have been so few computer specialists to go around, companies have tended to centralize their EDP operations. But these premises are now shifting as minis become more cost effective and as more people are trained in computers. An article, "At last, major roles for minicomputers" by Gerald Burnett and Richard Nolen in *Harvard Business Review* (Vol. 53, No. 3, May-Jun 1975), discusses four companies that have used minis differently. The authors suggest steps for management to analyze minis and assimilate them into the organization. Reprints (one article or mixed) $3.00 each (1 to 5) or 50¢ each (6 or more).

Reprint Service, *Harvard Business Review,* Boston, MA 02163.

TEKGRAPHICS

A quarterly publication that describes the latest software for graphic computer terminals and Tektronix customer applications. Recent issues have included articles about interactive mapping, urban planning and medical diagnostics. Free.

Tektronix, Inc., Information Display Division, P.O. Box 500, Beaverton, OR 97005.

ON-LINE NEWSLETTER

Covers computers in teaching and learning activities particularly in Michigan and adjoining states and provinces. Each issue carries brief reports, conference information, news, reviews, and comments. Those in the midwest will want to get *On-Line,* others will find the *SIGCUE Bulletin* more helpful. Six issues per year, $4.00 (free in Michigan).

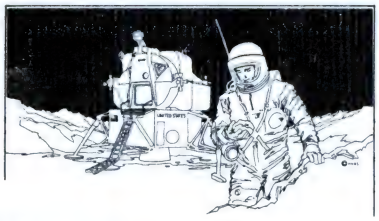
Karl Zinn, U-M CRLT, 109 E. Madison St., Ann Arbor, MI 48104.

PEOPLE'S COMPUTER COMPANY

A 5-times a year newspaper edited by Bob Albrecht carrying all kinds of diverse information about computer games, building your own computer, new hardware for hobbyists, information about people starting local public computer centers, and other related stuff.

Vol. 4, No. 1, although designated "Hardware Issue," had an excellent reprint titled "Community Memory – A Public Information Network" and another article "Starting Your Own (Community Computer) Center." $5.00 per year, sample copy $1.00.

People's Computer Company, P.O. Box 310, Menlo Park, CA 94025.



OUTWORLDS

One of the most diverse, interesting, and professional science fiction fanzines around. The personal touch of the editor, Bill Bowers, is very refreshing. Stories are of variable interest and/or quality, i.e., you probably won't like everything in every issue but you'll like something very much. Excellent graphics. Published quarterly. $4.00 per year, sample (double) issue $1.50.

William L. Bowers, Outworlds, P.O. Box 2521, North Canton, OH 44720.

THE COMPILER

An occasional publication of Anaheim Publishing Co., *The Compiler* is aimed at business data processing educators. Three or four articles per issue plus information on the latest books from Anaheim (mostly COBOL, Assembler and business EDP). Free.

Anaheim Publishing Co., 1120 East Ash, Fullerton, CA 92631.

PRIVACY JOURNAL

A monthly 8-page newsletter with news about privacy – new laws and regulations, new technology, and public attitudes. Generally, at least, fifty per cent of each issue discusses computer-related privacy. Looks at school records, crime data systems, medical records, mail lists, wiretaps, credit reporting, surveillance, computer security, etc. $15.00 per year, sample copy free.

Privacy Journal, P.O. Box 8844, Washington, DC 20003.

FOR NCR 399 USERS

Load & Go is an informal quarterly newsletter for NCR 399 users put together by Bill Moore and Jim Burmeister. It has hardware hints, commonly-used software routines, games, tips, and occasional reviews and letters. Not an official publication of NCR. $5.00 for 10 issues.

Bill Moore, Muskegon Federal Savings, P.O. Box 568, Muskegon, MI 49443.

COMMUNITY TELEVISION

Are you interested in improving the regulation of television broadcasting? Should cable TV and satellites be used to serve social needs as well as commercial ones? What's going on in community video? Public access TV? How about interactive TV in medicine? A video conference? TV in Russia? Reviews, equipment, news. If these things pique your curiousity then maybe you should try *TeleVISIONS,* a lively bi-monthly tabloid magazine now in its third year. $10 for 10 issues, sample issue $1.00.

Washington Community Video Center, P.O. Box 21068, Washington, DC 20009.

POPULAR COMPUTING

A monthly publication for people interested in the art of computing. Each issue contains 2 or 3 new interesting, and generally very intriguing, problems for computer solution, tables of roots and logarithms to high precision, essays on the art of computing, book reviews, and other related material. $15.00 per year, sample issue $2.00.

Fred Gruenberger, Popular Computing, P.O. Box 272, Calabasas, CA 91302.

DOOMSDAY + 1

Doomsday + 1 is a new comic book (you know, like *Superman, Detective Comics* or *Captain Marvel.*) Are you kidding? *Creative Computing* recommending comics? Yes, indeed. In case you didn't read Ron Anderson's article in *Creative* Vol. 1, No. 3, we should mention that cartoons and comics mirror the average person's understanding of technology (and computers) very closely. *Doomsday + 1* is set in the near future after a devastating nuclear war, but oh what the remaining computers and robot androids can do! Take a look. 25¢ at your local newsstand or $1.25 for the next six issues from Charlton Comics, Division St., Derby, CT 06418.

MICRO-8 USER GROUP

Ever since the plans for building your own computer, called the Mark-8, appeared in *Popular Electronics,* hobbists using the Intel 8008 chip (and later the 8080) have formed clubs and started newsletters to communicate with one another. The *Micro-8 Computer User Group Newsletter* serves 300 plus members all over the U.S. It's one of he best, print quality (vital for schematics) has improved dramatically from the early issues, although you still have to comb every page to find a specific item. $6.00 for 6 issues. Sample issue $1.00.

Micro-8 Computer User Group, Cabrillo Computer Center, 4350 Constellation Road, Lompoc, CA 93436.

MEDIA

SPACE: 1999

Did you catch the first episode of Space: 1999 on TV where the computer said, "not-enough-data-to-compute. HUMAN DECISION NECESSARY"? A close second to Star Trek, Space: 1999 is an excellent British TV series starring Martin Landau and Barbara Bain (remember Mission: Impossible?). Based largely on fact and well executed. Check your local listings; it's not a network show.

VIDEO DISKS

Within 5 to 10 years, video disk players will be commonplace in homes and schools. Add a keyboard, microprocessor, and memory device, and you've got an interactive super game player. Can you imagine going to your local record store and buying a video disk of space games, auto racing games, or word games? It's coming, gang. Today, however, you'll have to settle for a nice glossy 40-page booklet, MCA Disco-Vision." Free while they last.

MCA Disco-Vision, 100 Universal City Plaza, Universal City, CA 91608.

COMPUTERS IN SOCIETY

Two one-half hour radio interviews with M. Granger Morgan of the Office of Computing Activities, National Science Foundation on the "Impact of Computers on Society" are contained on this standard C-60 cassette tape. Order No. T-7404. $5.00.

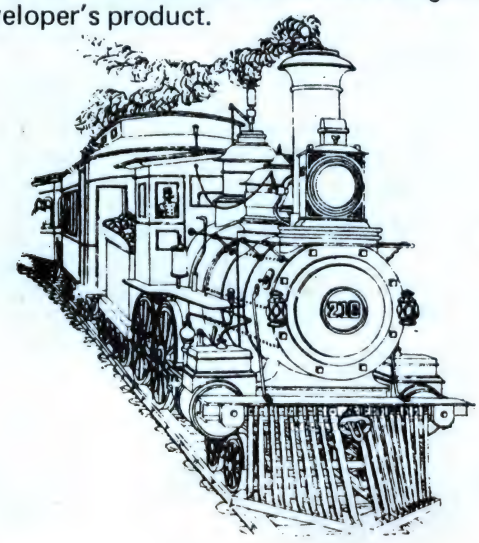
World Future Society Book Service, 4916 St. Elmo Ave., Washington, DC 20014.

Technical Transport Problems

by Trinka Dunnagan
University of Iowa

The CONDUIT project sponsored by the National Science Foundation is studying the current process of sharing instructional programs among undergraduate institutions. Believing in the contribution computers can make in education, CONDUIT is hoping to encourage classroom usage of good, computer-based curriculum materials by improving the overall process of courseware dissemination.

One major factor inhibiting sharing of programs is technical non-transferability of otherwise meritorious material. It is proposed that this obstacle can be overcome with a national solution. At the widespread, heterogeneous computing facilities of the CONDUIT consortium, technical transport guidelines are being evolved and tested. Such guidelines are based on preliminary experiments in program exchange, involving over eighty programs and five network centers (Oregon State University, Dartmouth College, North Carolina Educational Computing Service, and the Universities of Iowa and Texas). The proposed solution is to change the locus of programming effort from many unwitting recipients to the author. The failings of the present system stem from the fact that development occurs in a complicated environment where: 1) most academic professionals are indifferent to computer-based courseware making extensive involvement in instructional computing professionally unrewarding, 2) publishers are apathetic to computer-based materials thus the possibilities for commercial publication of courseware is limited, and 3) programmers reflect a general inexperience with other computer facilities thus fostering parochial development. Hopefully CONDUIT guidelines will mitigate development problems by supplying an alternative for optimizing transferability at the source site thereby improving the potential for wide dissemination and recognition of the developer's product.



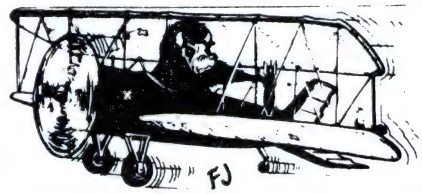
Considering historic transfer problems, one can see the need for guidelines; some of which are so simple-minded as to have always seemed obvious. The following is a summary of common technical transport problems typifying CONDUIT'S experience and motivating the development of transfer guidelines.

* Magnetic tapes become mysterious on different equipment for reasons such as: 1) "BCD" differs by a few characters on each new machine, 2) certain block lengths are unacceptable, 3) tapes may contain undocumented left-over garbage, 4) internal labels are inaccessible, and 5) external documentation does not exactly match tape contents.
* In some cases card decks arrived in uninterpreted form with local job control cards scattered throughout. Again the program listing and/or documentation would not always match the source deck.
* Once the program had been successfully read into the computer, calls to unexplained external routines, such as a random number generator, could cause program failure.
* Frequent, unacknowledged references to system dependent features, such as physical unit numbers, presented trivial but tedious errors to correct.
* Special devices, unavailable to the potential user, were required for program use in the classroom so no usage occurred.
* Through classroom usage, it was discovered that certain unexplored paths caused program failure or, even worse, that the program was theoretically unsound although free from syntax-level errors.

It is granted that all these problems are not solvable with technical transport guidelines. CONDUIT'S effort also involves educational documentation, program verification, tape transfer format (including a specification of BCD code for CONDUIT), authors' guides, and formal materials review. However, much can be accomplished by following simple rules of transfer programming. Other problems are more identifiable and correctable when a program is well-written. The following presents the major recommendations underlying CONDUIT guidelines for technically transportable programs:

* A standard, widely-diffused language should be used. For CONDUIT this language is either ANSI standard Fortran (based upon ANSI X3.9-1966, American National Standard Fortran) or a slightly revised version of the ACT

Flying Buffalo



by Richard Loomis

People are constantly asking me why I named my company "Flying Buffalo, Inc." Quite simply, I wanted a name that would attract attention. I thought about several names that related to wargames or simulations. But they all sounded similar to names that other companies were already using. The "Flying Buffalo" name was originally going to be used for my planned (but never finished) stamp and coin shop. I was going to have a picture of a flying eagle penny and a buffalo nickel. I decided to use the name for my game company, because I figured it would attract lots of attention, and be easily remembered. I was certainly right. I have received several requests to write articles about my company, we have been written up in newspapers, and we even got mentioned in the March issue of *Playboy* magazine!

I suppose now you are wondering what it is we actually do. We moderate multi-player, play-by-mail games on our computer. (Moderator: referee or umpire. Multi-player: the games have more than 2 players competing against each other. Play-by-mail: the players are located in various places around the world, and mail their moves to us. Computer: the machine which keeps track of all this.) Our most popular game is called *Nuclear Destruction.* We usually put 12 players in a game. Each player is given a country of the world. He has factories, missiles, and anti-missiles. He decides what to build with his factories, who to shoot his missiles at, and how to distribute his foreign aid. Any player may fire any or all of his missiles at any other player. If enough missiles are fired at a country, that player is out of the game. The idea, of course, is to get the other players to shoot at each other instead of at you. The players may exchange messages with each other in order to make alliances, threats, bribes, or whatever. The rules of the game are quite simple, but there are an infinite number of variations. We charge $1 entry fee, and 25¢ for each turn. The turns are two weeks apart, and the game generally lasts for about a year.

Our second most popular game is called *Battle Plan.* It is similar to *Nuclear Destruction*, but adds a lot of complicated rules for armies, navies, air forces, counterspies, research, and so forth. We usually put 6 or 7 players in a game of *Battle Plan,* and we charge 55¢ per turn.

If you would like to see the rules to *Nuclear Destruction* send 15¢ (or *Battle Plan,* send 50¢) to: Flying Buffalo, Inc., P.O. Box 1467, Scottsdale, Arizona 85252.

Is anybody interested in a research project? Think about this: In a game of *Nuclear Destruction* you have 12 different people of various ages, backgrounds, and physical locations competing in a game where the players may have conflicting goals. In one game you are likely to have people who want to win at any cost, people who want to maximize their positions in several games at once (that is, two second place finishes are better than a win and a last place), people who get bored and drop out, people who have entered the game only in hopes of meeting someone they have played against previously in order to get revenge, people who are totally irrational, and people who play merely to correspond with other people. We have players from 9 to 59 years of age. We have students, professors, servicemen, politicians, mechanics, musicians, doctors, and lawyers. They are located in Canada, California, New York, Florida, Alaska and Maine. We even have players in Switzerland, England, Austria, France and Israel. If some professor, or even someone looking for a degree, would like to write an article based on this game, we would be happy to enter him in several free games for research purposes. If you are interested, please write me at the above address.

Technical Transport continued —

TRANSPORTABLE BASIC (ACT Technical Bulletin No. 11).

* Programs should be modularized to improve explanation of program logic and to seriously reduce both original errors and transfer check-out problems.
* Use of structured programming techniques is strongly recommended. This approach reduces program complexity and increases readability by other persons.
* Explicit references to system specific features, such as a unit number for read or write, should be replaced by a meaningful variable name so that such parameters can be readily initialized at a new site with system specific values.
* Verifiability should be built-in to the program as much as possible so that out-of-range input data can be filtered out; calculation flukes can be caught, displayed, and bypassed; and intermediate results can be output upon request. Also present should be sample input and the subsequent computer results as well as computer-independent calculations for validating problematic algorithms.
* The last recommendation covered in the guidelines is completeness of documentation. Internal program documentation should comment program name, source, date, language, machine, operating system, core requirements, overall function, usage and options, important variables and parameters, and any references to external files, routines, etc. Every separate module should be commented similarly. The net effort is to make the program itself as technically well-documented as possible, the goal being ease of program readability by a programmer at another, remote installation.

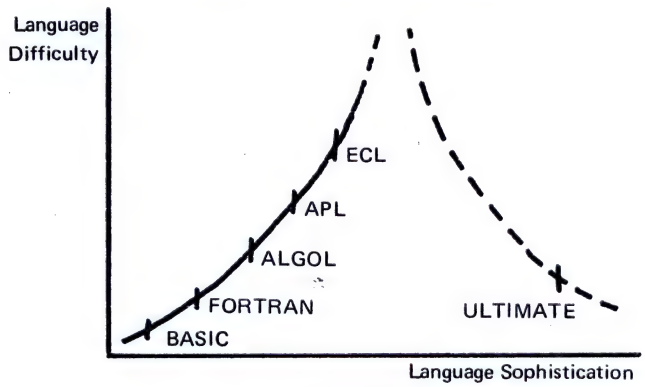
Implicit in CONDUIT'S strategy of improving programs at the source is the need for author incentives and rewards and a redistribution of resources to cover a possible increase in development costs. As CONDUIT is an experiment, it is hoped that cost-benefit analysis will justify transfer programming, and that mechanisms for program dissemination will permit cost recovery, promote authors' prestige and ultimately facilitate innovative usage of computer-based curriculum materials in the classroom.

Eclectic Programming Languages

C. Terrence Ireland and Norman S. Glick
The George Washington University

Where are programming languages headed? Will there always be many languages, or will there be one ultimate language? Will BASIC and FORTRAN disappear from the scene, replaced by new improved languages? Presently, the complexity of new improved languages discourages their general use.

One end of the curvilinear relationship between general purpose computer language difficulty and computer language sophistication is clear; the other end is faith. The middle is hazy. The Display shows a partial construction of this relationship. You should feel free to rearrange the languages in the Display to fit your own beliefs.



Display

Simple languages are easy to use because they have few constructs that you must absorb into your intuition. More recent languages carry an expanded syntax, which opens up new opportunities to instruct the computer. It will, however, take you longer to absorb the expanded syntax into your intuition; you may not find the time. One attempt at requiring programmers to publish their algorithms in a language with an expanded syntax ended in failure. Most scientific programs are initially written in FORTRAN. The Association for Computing Machinery once required that published algorithms be written only in ALGOL, a language more sophisticated than FORTRAN. As a result many of the ALGOL programs mimicked the original FORTRAN programs, instead of taking advantage of the additional sophistication available in ALGOL. Unfortunately, it is also true that well-programmed ALGOL algorithms must often be translated back into FORTRAN or BASIC to run on your machine.

The Ultimate Language appears at the other end of the curve, which hopefully has descended back into view. Perhaps the Ultimate Instruction will be "You know what I want. Do it!" Presently, the Difficulty Curve for general purpose languages is still going up, and the predicted time of descent is moving farther into the future.

An Extensible Language

New languages should be eclectic: "not following any one system, . . . , but selecting and using what are the best elements of all systems." An eclectic language permits a very rich set of elements, but you must choose among them. The choice can be very hard, particularly for novice users of the language. Many will want to be constrained by a simpler language; at least it keeps you out of trouble.

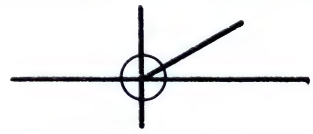
An eclectic language system, ECL, has been developed during the last five years at the Harvard Center for Research in Computing Technology. This extensible language allows you to reach out and select the "best elements." You can even change ECL language elements that you dislike, and add new ones for your specific application. Never mind how ECL appears to others. What counts is how it appears to you. If you want to redefine "=" to mean different things in different contexts, as in PL/I, then extend ECL so that

$$A = B = C$$

means set the value of A to "true" if the value of B is the same as the value of C, otherwise set the value of A to "false". Make sure, however, that you keep such activities secret!

ECL does not have complex numbers. Why not add them yourself. You can:

1. Define a new type of data, call it COMPLEX.
2. Extend the usual arithmetic operators +, −, *, and / to handle the corresponding operations on COMPLEX numbers.
3. Construct a natural print value for a COMPLEX number. Either
   a. The algebraic form, a + bi.
   or
   b. The picture form, an Argand Diagram, e.g.



4. Extend exponentiation to include COMPLEX numbers.
5. Et cetera.

An extensible language must also be contractable. Once you expand ECL for the complex number user, you can contract other features that do not interest him. He sees only the language he wishes to see. In a similar manner, you can construct a BASIC-like language.

ECL gives you the opportunity to produce your own extensions "as naturally as possible" in a well-understood high level "core language." But there is a cost. To tie together all the characteristics of the complex numbers into one package requires a lot of code. You can build a beautiful vertical structure; each layer of the structure feeds into the next higher layer to permit simplified programming at high altitudes. You can operate on complex types of data with the same ease that you can add two numbers in BASIC. It does take time to develop any such structure. If you use the entire package often, the development time is well-spent. Perhaps your needs are less comprehensive or you want something simple in a hurry. Perhaps someone else will eventually write the package for you. ECL is a powerful system, but it is still on the upward side of the Difficulty Curve.

People have different reasons for writing programs. At least three reasons are visible:

1. Instruct your computer to apply an algorithm to a set of data, and to return to you the result of the application.
2. Transport your programmed algorithm to another

"Very good. Please continue." A New Approach to Testing

Sandra J. Hershkowitz

The development of computer-generated examinations is fairly recent, but the use of such testing is spreading rapidly; in fact, the first CATC (computer-assisted test construction) conference has recently been held in San Diego to provide information about and experience in this area.

For my master's thesis in education, I devised a computerized testing system, with the hope of increasing learning and motivation in an introductory computer science course. With the generous cooperation of Dr. Ronald Wojcik (who was then affiliated with St. Bonaventure University) and his staff, the exams were used by 63 undergraduate students in order that the system could be evaluated and student reaction obtained.[1]

Basically, the idea is as follows: Students are taught in whatever manner is usual but are tested so that they are competing with *themselves* rather than with the rest of the class. Exams are administered via "terminals", typewriter-like machines hooked up to a computer, which may be located in the school building or may in fact be miles away – in one of the many computer centers located in colleges, universities, or business corporations throughout the country.

The student identifies himself on the typewriter, and testing begins. A question is typed out for the student to answer. Questions are chosen at random from a storage bank of questions so that each student's exam is unique. Because the student is competing with himself, he is encouraged to take each exam several times, with the idea of improving his previous high score. The use of randomly selected questions means that a student's retests will also be different; therefore he is being exposed to a large amount of material covering a particular unit or area and is not merely taking the same exam over and over.

Questions are corrected immediately as they are answered. If the answer typed in by the student is correct, he is given an encouraging comment and asked to proceed ("Very good. Please continue.") If the answer is incorrect, an appropriate comment is typed out ("The correct answer is ..... . Why don't you take a look at this later?"). At the end of the exam, the student is given his score, along with his previous high score, and the areas needing review are listed. He may then remove his corrected paper, with comments, and use it for further study.

In the particular system used by the St. Bonaventure students, there were three units or areas. Each unit exam contained 25-30 objective-type (true-false, identification, multiple-choice, fill-in) questions, chosen from a storage bank of approximately 300 questions; and students were allowed to take each exam up to nine times, with a two-week period allowed per unit. A questionnaire was administered to assess student reaction, and the responses were very gratifying. Students overwhelmingly liked the exams, they liked the interactive approach and the repeatability option, and they felt they were learning more using the exams.

Such a testing system is a practical reality – it is adaptable to many subject areas at any level and does not involve great expense. It can be programmed on a small computer; and, as mentioned earlier, a computer does not have to be on the premises. Students may retest themselves on a particular unit and try to improve themselves with each retest. They can use their completed exams as study aids and receive each exam, graded, immediately as completed.

Another point not to be overlooked is the value of such a testing system to the teacher. In addition to being freed from administering and grading exams, the teacher can readily obtain desired statistical information, continually updated. (For example, for a particular unit: number of times each question is answered correctly; how many times each student has taken the exam; mean and standard deviation of high scores for the unit; individual scores for each student; and so on.)

With the increasing use of individualized learning programs, computer-generated examinations fit in perfectly. A student may proceed at his own pace and take the exams appropriate to his level of learning.

[1] "Interactive Testing-Evaluation in an Introductory Computer Science Course" by Sandra J. Hershkowitz and Ronald Wojcik, *Journal of Educational Data Processing,* Spring, 1975.

Eclectic Languages continued –

machine so that it can apply the algorithm to a set of data, and can return the result of the application.

3. Transmit the knowledge of the algorithm to someone else.

If you write for Reason 1, you write in the available language of your choice. Many will write in the first language learned, some will write in the second language learned, one or two will write in the best language available. The best language for Reason 1 is not necessarily the best language for Reason 2. That is the dilemma. To transport an algorithm to another computer, you must write in a language known to it. Will there ever be one language for all of us?

A Universal Language?

Computer scientists are confronted with an astounding decline in the price of computer hardware. The technology that has generated the dramatic and rapid cost reductions that you have noticed in the hand calculator market will produce, probably within five years, very powerful computers at costs within the reach of anyone who can afford a TV set.

Remember that the curvilinear relationship described at the beginning of this article is subjective. Even today what one computer user finds difficult, a "programming linguist" might find easy. When the butcher, the baker and the candlestick maker have that sophisticated computer hardware available to them, how will they communicate with it? More and more people will find the effort to learn even languages like BASIC to be more than they are willing or able to exert. The pressures on computer scientists to come closer to the ultimate instruction will intensify.

But wait; further development of eclectic languages like ECL may give the professional programmer much better tools to develop "easy" specialized extensions (read "languages") for classes of users: the butcher class, the baker class,. . . The kind of professional programmer who is equipped to develop custom languages for others is likely to be willing and capable to exert whatever mental effort is required to achieve fluency in a sophisticated language. But the casual user of computers, whose numbers will increase substantially in the next several years, must be given simple languages – he will tolerate no other kind. Unlike today's general purpose "simple" languages, though, the simple language of the future will not have a few constructs to absorb into the intuition, but a few constructs that are already part of the intuition.

Few people will learn the full-blown eclectic language, but many will learn the intuitive extensions.

Computer Abuse

The Need for a Rational Perspective

by David P. Snyder,
Research and Operations Analysis Division,
U. S. Internal Revenue Service*

Computers, like most modern scientific and industrial developments, have had a lot of bad press. Technology of all kinds has provided the popular media with an increasing number of themes and plots in recent years. Even documentary books about dysfunctional technological performances have made the best seller lists (e.g., *The Silent Spring, Unsafe At Any Speed*). I mention these popular treatments of technology because they are the principle means by which the general public becomes conscious of the technical aspects of its environment. Few of us have ever been inside a submarine, but most of us have a pretty good personal conception of what we think it would be like, because of the detailed representation of submarines in books and films.

And so it is that most people "know" about computers. They have read, (or read about) "1984" which has, in only 25 years, come to epitomize the public's image of the "computerized society." As required reading in many high school curricula, Mr. Orwell's social-science fiction novel has already served to give its author's name to an era that has not yet (and hopefully will never) occur. This single fictional image has become so strong that Washington bureaucracies tended to terminate their 1974 10-year plans with Fiscal Year 1985 rather than calendar year 1984 (like hotels which "skip" the 13th floor). And, in the milieu of continuing post-Watergate revelations of secret data banks, wire-taps, martini-olive transmitters and other elaborate electronic arcanery, "Orwellian" has replaced "Kafka-esque" as the most widely-used intellectual epithet.

Given such an environment, only the most hearty proponents of automation are not speaking cautiously about computers as being "two-edged" swords, whose power for social and political evil must be carefully proscribed before we can avail ourselves of their economic and intellectual benefits. Of course, it has always been easy to conceive of any technology as an anti-social force, since the existence of only one potentially destructive application will make a technology suspect. Upon the briefest reflection, we should quickly see that only the most trivial technological innovation would be completely free from such drawbacks. (The umbrella is the most recent one I can think of.) This is why it is so difficult to contrive a believable concept of Utopia; by definition, utopia must be perfect in every detail; every man a king and no one's oxen gored. By contrast, a possible socio-political nightmare may be easily conceived simply by amplifying any one of a number of existing social, technological or political imperfections.

Of course, the mention of "imperfections" raises another popular target of computer critics. Computers are not perfect; they make mistakes. Never mind that the vast bulk of these mistakes are the fault of those who programmed or loaded them. Those who mistrust computers have ample justifications for their concerns. What kind of confidence can we afford to place in a system which obstinately screws up our department store charge account for 14 consecutive months? How can we possibly assign significant responsibilities to a device which inexplicably sends sewer and refuse service bills to 3rd grade students in lieu of their report cards? In short, somewhere between the public's fictionalized and personal computer experiences there has emerged the image of a frighteningly powerful yet slow-witted and malicious servant who is not to be trusted.

Small wonder, then, that practically every innovative computer application is challenged with a flurry of adversary questions which reflect about as much substance and factual comprehension as the old, "Yes, but would you want your sister to marry one?" Let's take just one current example. Several state and local jurisdictions have recently adopted, or are considering adoption of, a computerized psychological testing service to be used by a variety of public services such as juvenile aid, correctional agencies, mental health, social welfare, and education. The economic incentive is clear enough — consulting psychologists charge $100–$200 to administer such tests, while the computer testing service will charge only $3.00–$5.00 to analyze and score a psychological profile administered by any public service employee.

Of course, our normal first reaction to such a proposal is one of horror; here is the archetype of computerized dehumanization! I am inclined to share such concerns, but not because of the use of the computer. Rather, I am extremely skeptical about our ability to accurately encapsulate an individual's psychological nature in a questionnaire, regardless of who administers it and how it is analyzed. *However,* clinical tests *have* shown that doctors, conducting medical examinations of patients with routine

Members of panel session on "The Communications Revolution: Creating the Global Community", at the Second World Future Society General Assembly, June 3, 1975. From left to right: Stuart Brand, Publisher of the *Whole Earth Catalogue,* Robert Theobald, Socio-Economist and Author, Bob Johansen, Communications Researcher, Institute for the Future, and Dave Snyder, Management Analysis Officer, U. S. Internal Revenue Service. (Photo: Courtesy of World Future Society Photographer: Jim Mack)

*The views expressed in this article do not reflect the policies or practices of the U. S. Treasury Department, and are solely the personal professional opinions of Mr. Snyder.

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ailments and using a standardized set of diagnostic criteria, are *less* accurate in their diagnoses than computers analyzing the identical criteria.

The explanation for this disparity in performances seems to relate to several factors, including the doctor's state of mind, and their reactions to extraneous aspects of the patients' physical appearance and personality. The significant point here is that, for routine, repetitive situations of all sorts, where criteria/characteristic relationships are well understood and empirically demonstrable, computers do have legitimate, cost-effective application potential, and in fact, may well out-perform their human counterparts. (Computer auto diagnostics are a superior example of this sort of application.)

While we're on the subject of human shortcomings, let me bring up a couple of additional study findings of the past several years which serve, I believe, to put the computer into better perspective. For example, clinical experiments strongly suggest that human analytical processes tend to remain unchanged, even in the face of extremely high rates of dysfunction. In one test, (Goldberg, *American Psychologist,* 1970), diagnosticians were given a hypothesis about the interpretation of certain test results, along with several corroborating case histories. Using these criteria, the clinicians were given a series of test cases to analyze, receiving immediate feedback regarding the correctness of their evaluations. *It took an 80% failure rate* to make them consider abandoning the criteria they had been given and to search for a more suitable one.

Data such as this suggests that the human mind tends not to be adaptive. Yet a computer can be programmed to put reviewers on notice whenever a failure rate on a routine procedure reaches an unacceptable rate, which we would judgmentally set considerably lower than 80%. There is clinical experience which suggests further, rather severe limitations to man's cognitive and perceptual abilities. Numerous studies tend to corroborate George Miller's original hypothesis that the human mind can handle no more than 7 ± 2 different data elements at the same time. Stafford and de Neufville state not only that it is impossible for humans to make reliably consistent comparisons between objects with more than one dimension, but that human judgment, particularly in non-linear decision situations, is clouded by personal psychological utilities. (*Systems Analysis for Engineers and Managers,* McGraw Hill, 1971.)

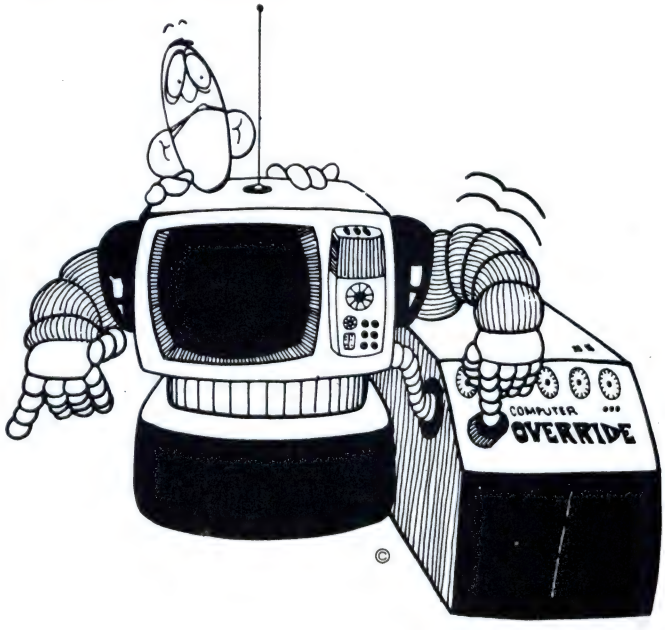
Thus, man is not without his shortcomings as an analytical tool, as the supercilious HAL observed in Arthur Clarke's "2001". In fact, one might go so far as to suggest that man is a 'double-edged sword' whose potential for social and political evil must be carefully proscribed. An absurd analogy, and yet, of course, we do proscribe man's potential for doing wrong through our laws. And so too, I suggest, should we deal with the negative potentials of computers.

Basically, of course, when we talk about the regulation of computers, we are really talking about controlling the use and abuse of data. A variety of approaches have been suggested for the regulation of data banks. Some people have proposed that certain classes of personal data simply not be automated (or even collected at all, for that matter). Others have proposed that the collection, processing and distribution of information be licensed by the government. The most far-reaching, concrete action of this sort has been the Swedish Data Act of 1974, under which no computerized personal data file may be established or maintained without a permit issued by a Data Inspection Board, which also issues and enforces standards for file size and content, security, disclosure, and data sharing.

It is clear that there are a variety of proposals for data bank regulation which would be workable and effective. Such proposals, however, fail to address a critical reality which will become an increasingly important central feature of the information age. This reality is that information has economic value. There is ample evidence of this in the every day life of organized social, political, and economic enterprise. Institutions spend millions of dollars on reports and studies to aid them in making correct decisions. The sale of abstracts, digests, bulletins, news and technical journals run into the billions of dollars. Mailing lists, particularly when associated with socio-economic data, are of enormous value for marketing purposes. Patent holders sell or lease the rights to use their ideas. The "all news" radio format is now the biggest money maker in the audio broadcast industry. Institutions pay millions of dollars each year to send employees to schools, seminars, and conferences . . . presumably for the knowledge which the employees will acquire for use within the institution.

Of course, information has always had value, and has always been bought and sold; but never on so large a scale or in so large an amount as it is today. The primary reason for this is the complexity of the modern world. Decision-makers seek to minimize risk; with the increased variety in our society, more and more data must be gathered and analyzed in order to determine the probabilities associated with a given decision. It is clear that this situation will continue to accelerate as individuals and institutions seek to improve upon the sub-optimal decisions of the recent past. Thus, the compilation, analysis, and distribution of information will become a vital global industry in the coming decade. Some have speculated that it will become the dominant industry. Given these circumstances, it would seem extremely desirable and patently reasonable that we should immediately begin to treat information as an economic commodity.

First, it should be pointed out that the courts have long linked the protection of personal privacy to the legal conception of property rights. In this context, the unauthorized acquisition and/or dissemination of private information has been treated under the laws pertaining to trespass; while the unauthorized distribution of legitimately acquired data is regarded as a breach of contract. (The new Swedish Data Act established "Data Trespass" as a new form of crime.) Thus, for most personal data, the law is already well established with regard to the treatment of information as a commodity.



However, an economic link between an individual's personal data and its use for purposes other than that for which it was originally solicited has *not* been established. As a result, credit card firms or universities may sell to third parties data which they have required of their card holders or their students, although the original "owners" of the data receive no compensation. Further, governmental authorities require many institutions to provide them with aggregate data, at no cost, for the purpose of public policy and law making. If the economic nature of data were established, data would be paid for as with any other resource, and individual persons or corporations would receive some remuneration for the use of their individual data. Further, if the principles of information economics were widely practiced, institutions would cease to view data as a "free commodity", and much unnecessary, inefficient or duplicative reporting would be dropped. Direct, economic incentives for increased efficiency in data handling would be far more effective in curtailing burdensome public reporting requirements than a dozen Hoover Commissions.

Let us examine how such an arrangement might work. A principle candidate for the economic treatment of data would be the nation's banking and financial institutions. These organizations, which possess vast amounts of personal data, will soon acquire even more, with the completion of the Electronic Funds Transfer System (EFTS), and the accelerating evolution of the so-called "cashless society", through the expanded use of point-of-sale terminals and direct electronic transactions, such as consolidated payrolling. The more than 40,000 financial institutions who will participate in the EFTS will comprise a massive distributed data base, from which enormously valuable economic information might be generated on a para-real time basis.

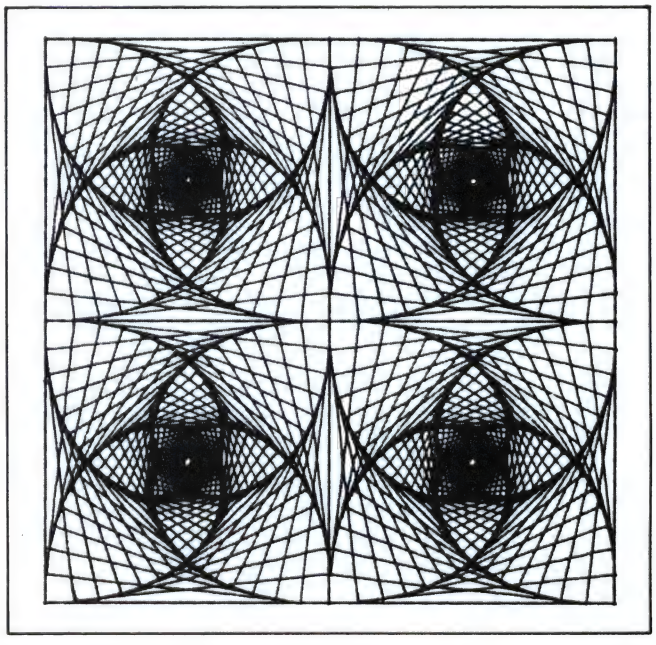
If the present non-economic view of data continues, these financial institutions would conceivably generate some limited saleable information from their vast data-net whenever it was an attractive spinoff from normal operations. Presently contemplated legislation would, however, put up serious barriers to the use of personal data for purposes other than that for which it was originally collected. (Such legislations would generally promote the necessity of duplicative data gathering throughout the nation, in order to protect personal privacy.) If, however, a formal information economy were to be promoted, the EFTS might be used to generate great quantities of vital data for sale to the public and private sector, with a portion of the profits to be returned to the customer/owners of the initial inputs, perhaps in the form of additional interest on their savings accounts. The published data from such a system would be no more intrusive upon personal privacy than Census data, and would be collected as a by-product of customer transactions.

Ultimately, such an arrangement could evolve into a wholly new institution, a data banking system (DBS). The regulation of a DBS would take form similar to that already applied to the nation's money banks. Data Banks would be fiduciaries for the information they hold, just as regular banks are fiduciaries for the money they hold. There would be penalties for the violation of the fiduciary trust, such as misuse or misappropriation of personal information. *And,* of course, just as individuals are subject to penalties for passing bad checks or counterfeit money, so too would individuals be subject to penalties for giving false information about themselves to the bank. The recognition of information's economic value would promote institutional interest and resource commitments in the protection of data, similar to those control and accountability measures which organizations take to protect inventories of other costly resources.

Of course, many people would argue that such a proposal does not come to grips with the critical social and technological problems inherent in controlling computers and protecting personal privacy. I do not agree. *Any approach to regulating info-com technology will be less than perfect;* just as any approach to regulating the banking industry will permit some misappropriation of funds, and once in a great while, a bank failure. Those who anticipate the development of a fool-proof data protection technology based upon voice or fingerprint analysis or some other such esoterica simply do not understand the problem. So long as there is potential gain to be derived from the misuse of personal data, it will be misused. As with other human transgressions, laws must be enacted and enforced against "data trespass", and other information related crimes. Laws should *not* be passed constraining the use of info-com technology, any more than laws should have been passed against automobiles in the early 1900's (e.g., Laws which required a driver to proceed his automobile by several hundred yards, on foot, to warn citizens of his vehicle's approach. Or laws barring the use of autos between sundown and sunup, or on the Sabbath.)

Above all, we must not convince ourselves that a fool-proof data security process is essential before we can permit the development of the major information-nets and data bases essential to our present critical research and decision-making needs. In the first place, such security measures will clearly not be quickly forthcoming, if at all. But, more importantly, if we will only place our trust in technological perfection, it means we will have abandoned altogether our faith in the rule of law, in our institutions, and in our fellow men. *This would bring about the true dehumanization of automation — a society in which trust is reserved for perfect, inviolable systems.* There will be risks involved with the creation of the information society, just as there have been risks in all of mankind's great adventures. The risk-avoiding alternatives available to us are the sterile pursuit of problematical technical perfection, or the stagnation and decay of inaction. I, for one, would prefer to accept the computer, 'warts and all'. The game, as they say, will be worth the candle.

[Note: Whatever mechanism is evolved to manage and control info-com technology, it seems apparent that, within 10–15 years, we will see an information industry regulated like a public utility, with profit margins and capital investment priorities, controlled by public commissions.]



Creative Computing Compendium

This section of *Creative Computing* consists of news, notes, quotes, and short bits about this computer age in which we live. It was compiled and edited by Trish Todd, a freshman at Brown University along with David Ahl.

That's Entertainment

Switch from entertainment to education in seconds, says Philips/MCA of a videodisc system scheduled for fall 1976 production. Consisting of pre-recorded videodisc albums and a videodisc player that attaches to any standard home television receiver, the system will relay full color or black-and-white pictures and sound. Features: random access, speed-up, slow-down, freeze frame, reverse, and picture-by-picture presentation. The company claims that it's "easier to operate than a conventional phonograph, and simple and safe enough for a child to handle." For further information, write Lester Krugman, North American Philips Corporation, 100 East 42nd St., NY 10017 (212-697-3600).

American Libraries

Computer Science Conference in Anaheim

The Association for Computing Machinery announced that the Fourth Annual ACM Computer Science Conference will be held at the Disneyland Hotel in Anaheim, California on February 10-12, 1976. The Conference will feature short reports on current research in computer science by students, faculty, and researchers in the computer and information sciences. Over 1,000 attendees are expected.

In conjunction with the Conference, the ACM Special Interest Groups on Computer Science Education (SIGCSE) and Computer Uses in Education (SIGCUE) will hold a joint technical symposium on Computer Science and Education.

SIGCSE Meeting in Williamsburg

The Sixth SIGCSE Technical Symposium is scheduled for July 26-27, 1976 in Williamsburg, Virginia. The primary focus of the program will be on contributed papers in all areas of computer science education.

Contributed papers, with three copies are to be submitted to Professor William Poole, Mathematics Department, College of William and Mary, Williamsburg, Virginia 23185, with a March 15, 1976 deadline.

New Program Detects Typos

A computer program to catch typographical errors before they appear in print has been devised by two Bell Labs. researchers. Said to be the first of its kind ever developed, the program is fast, needs only limited computer storage capacity, and is easy for the proofreader to use, according to its developers. It will also help detect typographical errors in foreign languages as well as in English. The program cannot detect typos without human assistance. After the original document is input, an "index of peculiarity" for each word in the document is computed. The computer then displays or prints out a list of the words, with those most likely to contain typos listed first. It is then relatively easy for the proofreader to find and correct the typos. In one trial of the system, a 108-page document of nearly 20,000 words was examined for typos in three minutes by the computer. The author of the document needed less than ten minutes to scan the word list and locate 30 misspellings – 23 of which occurred in the first 100 words listed by the computer.

Modern Data

The $10 Computer Arrives

The "$10 computer" is no longer a joke. Hard on the heels of an announcement by National Semiconductor of the $48 computer, American Microsystems, Inc. (AMI) has introduced the "$9.98 computer," complete with program and data memories and input/output facilities.

Of course, you have to buy 5,000 at a time to get the $9.98 special price, but even 5,000 will only cost you $49,900, about the price of two minicomputers a few years ago. AMI expects the fixed-program computers to be used in calculators, portable data entry devices, cash registers and appliance controllers.

The S9209 computer comes with a 6K bit read-only memory for program storage, a 256 bit random access memory for temporary storage and input/output lines. The system handles 33 basic instructions with a typical instruction cycle time of 15 microseconds. Several of the microcomputers can be connected in tantrum for applications requiring increased capability.

Minicomputer News

A Career in Data Processing – 120 Years Ago

No. 3R6018 Fountain Pen only, without assortment. Price, each.....8c
No. 3R6020 Fountain Pen Filler, for fountain pen use; straight glass with seamless rubber bulb. Price, each.....4c
If by mail, postage extra, 2 cents.

The closest career to data processing 120 years ago would probably be the position of a clerk in a manufacturing or financial institution. Are "the good old days" for you? Here are the "Rules for Office Staff" posted in 1854 by Huddleston & Bradford, a banking firm in London, England.

1. Godliness, cleanliness and punctuality are the necessities of a good business.
2. The firm has reduced the working day to the hours from 8:30 a.m. to 7 p.m.
3. Daily prayers will be held each morning in the main office. The clerical staff will be present.
4. Clothing will be of a sober nature. The clerical staff will not disport themselves in raiment of bright color.
5. A stove is provided for the benefit of the clerical staff. It is recommended that each member of the clerical staff bring 4 lbs. of coal each day during cold weather.
6. No member of the clerical staff may leave the room without permission from Mr. Roberts. The calls of nature are permitted and clerical staff may use the garden beyond the second gate. This area must be kept clean in good order.
7. No talking is allowed during business hours.
8. The craving of tobacco, wines or spirits is a human weakness, and as such is forbidden to the clerical staff.
9. Members of the clerical staff will provide their own pens.
10. The managers of the firm will expect a great rise in the output of work to compensate for these near Utopian conditions.

– DHA

HP Educational Programs Clearinghouse

Have you ever felt that it would be so convenient if you could run French lessons or metric conversion exercises or a career information system on your computer? Information about the existence of such materials is not readily available; therefore, Hewlett Packard is launching the HP Clearinghouse for Application of Computers to Education.

The purpose of the project is to establish and maintain a list of educational applications, books, and other computer-related documents that will run on HP computer systems (both 2000 and 3000 series). Initially, the Clearinghouse will only deal with information concerning such materials; the materials would still be available from the current service agency. Catalog listings will be generated at periodic intervals and distributed for a small charge.

If you have materials that you would like included in the Clearinghouse, please contact: Harold J. Peters, HP Clearinghouse, Education Marketing, Hewlett-Packard, 1000 Wolfe Road, Cupertino, Ca. 95014.

Freedom of Information Act

Because concern in the United States has been stewing over the amount of information that our government collects about its citizens, concern has also been mounting over how to release this information to the public. Despite a presidential veto, the Freedom of Information Act (FOIA) has recently been amended in order to provide more clearly defined situations in which the government may or may not withhold information.

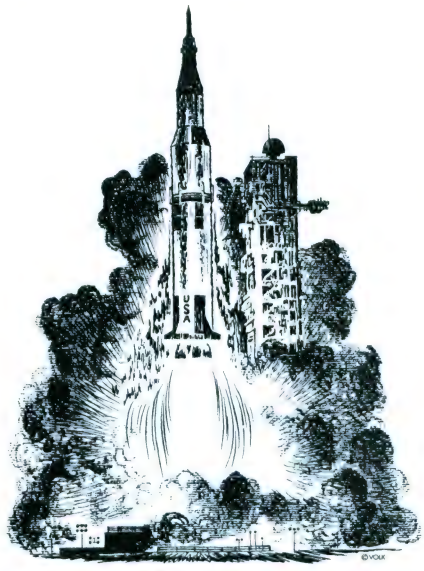
The FOIA became effective on July 4, 1967 and was designed to force government agencies to be more liberal in releasing information by establishing nine "exemption areas" as the only situations in which information could be withheld. Anyone requesting information from the government could take his case to court.

A recent House Subcommittee study showed that courts are generally reluctant to ask for disclosure of information such as files compiled for law enforcement or information in the interest of "the national defense or foreign policy". Although these are two exemption areas, the Congress did not intend for these situations to mean the automatic withholding of information. In 1974, amendments were passed over the presidential veto to prevent this sort of automatic delay in disclosure of information.

President Ford did not feel that courts should be "forced to make what amounts to the initial classification decision in sensitive and complex areas where they have no particular expertise." He also mentioned in his letter to Congress that confidentiality would be hard to maintain if government documents had to be closely examined before decisions could be made on their disclosure.

Computers, and society's increased use of numbers as identifiers have made it easier to gather and file information on citizens. The 1974 amendments to the FOIA have at least made this information more accessible to those it concerns.

Space Shuttle Simulator



The first shuttle mission space flight is scheduled for March, 1979, but preparation for the flight begins years in advance and is an extensive and complex process. The National Aeronautics and Space Administration recently purchased a large scale Sperry Univac 1100/46 computer system to be used in the training of flight crews and ground personnel in all phases of the Space Shuttle Program.

The computer complex will be a major part of the Shuttle Mission Simulator (SMS), and it will include simulation of the orbiter vehicle, main engines, solid rocket motors, external tanks, support equipment, and other activities required to fulfill the mission's objectives.

The main purpose of the complex will be to interact independently or simultaneously with the simulator fixed base and motion base crew stations as well as a full network simulation, all on a real-time basis. Since the computer system has multi-processing capabilities, it will also operate in remote batch, batch and demand situations. Training operations are scheduled to begin in March, 1978.

World Problems and Human Potential

Everyday, society is faced with discussion, debate, and concern about the world's problems. Everyone, it seems, is trying to solve a different problem, and not much attention is given to the relationships between problems. Therefore, the Union of International Associations began a data collection exercise using a network of 2500 international governmental and non-governmental organizations. Information was gathered on problems that these organizations felt concerned or was relevant to them, and it was compiled in the *Yearbook of World Problems and Human Potential.*

The project was produced from text held on the magnetic tape files of UIA's computer. Each world problem has a four-digit number in ascending numerical sequence which serves as a reference for the computer, filing, indexing, and cross-references. The system now contains 2560 world problems, but it can hold 3700. Each problem is also given a textual description and cross-references/indexes. This large amount of interrelated information is displayed through maps which are plotted by a computer. These maps enable people to plot their position in the social system just as they would check their position on a road map.

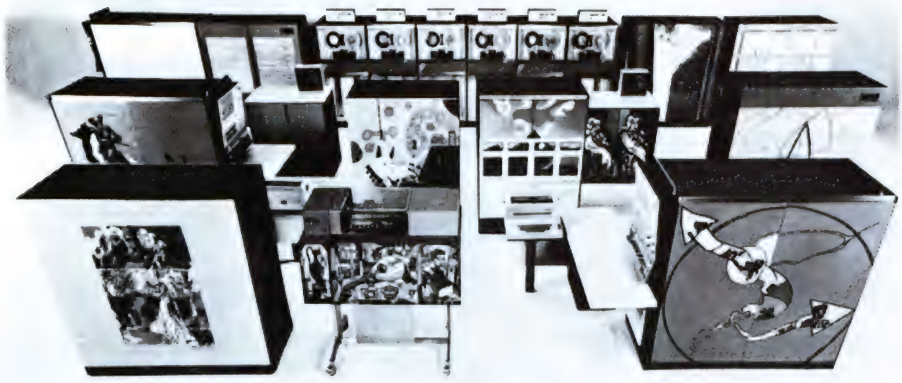
Because the collection of such an enormous and indefinite amount of information is such a difficult task, the aim of the project has been to establish a framework for processing data rather than to provide a definitive end-product. Hopefully, this process will make it possible to improve methods of gathering large amounts of information from diverse sources and make the result work for man toward a definite purpose.

For more information, write Anthony J. N. Judge, Asst. Secy-General, Union of International Assns., Rue aux Laines 1, 1000 Brussels, Belgium.

ACM Student Paper Winners

A committee consisting of graduate students at Massachusetts Institute of Technology chose Guy L. Steele, Jr. of Harvard University as the winner of the fourth annual George E. Forsythe Student Paper Competition for 1974-75, sponsored by the Association for Computing Machinery. For his paper, "Multiprocessing Compactifying Garbage Collection," Mr. Steele won $200 cash, a three year subscription to the ACM serial of his choice, and a trip to Minneapolis/St. Paul to receive his award at the 1975 ACM Annual Conference.

John L. Bentley of Stanford University and R. Mark Claudson, a high school student in Richland, Washington, tied for second place. Mr. Bentley's paper discussed "Multi-Dimensional Binary Search Trees Used for Associative Searching," and Mr. Claudson wrote about "The Digital Simulation of River Plankton Population Dynamics."



Computers Become Art at Lincoln Center

Fourteen artists from across the country participated in an unusual art show recently at Alice Tully Hall in New York's Lincoln Center cultural complex.

On exhibit were paintings representing a wide range of styles from landscape to surrealism. All were on computer equipment. The showing is part of a new corporate program to humanize working environments. It's called "A program to encourage the advancement of environmental art." The sponsor is James Talcott, Inc., a major New York City-headquartered financial services corporation.

In commenting on the showing, Donald S. Alvin, Talcott's vice president of marketing, said: "There has been great progress in moving art out of museums and mansions into more public environments. But there's one area where too little has been done. This area is perhaps the most important. It's where you and I spend most of our waking hours and nearly half our lives. It's the working environment.

"We at Talcott see no reason why art should top at the door of business. What we do see is a great opportunity to bring art to where most of the people are, most of the time. At the very least, it will make people a little happier. It might even result in better work."

With the advice of major museums, Talcott identified fourteen talented artists from across the country and commissioned them to humanize the computer technology environment.

"We chose the computer for two reasons," said Alvin. "It's an area we have been involved in for many years, and it's one of the most challenging and sterile working environments. In many ways the computer area symbolizes what's wrong with too many working environments. It's a place designed solely for efficiency and expediency. And in a large part, for machines."

[Ed Note. While the 14 selected artists were certainly respected and well-known, we at Creative Computing *wonder why no computer artists were invited to participate. It seems rather curious – DHA]*

ACM Policy on Universal Identifiers

How many times have you commented on the amount of numbers that identify you in society? We have charge account numbers, license numbers, Social Security numbers, insurance policy numbers, school I.D. numbers; the list is endless. A universal identifier would combine all of these identities into one number, and, with the use of computerized data banks, a specific individual's records could be quickly located for all number needs.

On November 14, 1974, the Association of Computing Machinery adopted a resolution regarding the use of the universal identifier. The A.C.M. acknowledged that a universal identifier would be beneficial to society and its individuals by simplifying the process of locating and comparing information about individuals. However, the A.C.M. felt that present technical, organizational, and legislative efforts to prevent possible abuse to the individual's right to privacy have *not* been adequate. The council urged the prompt generation and passage of legislation that would prevent the misuse of universal identifiers, including the Social Security Number.

FBI Computer Plans Grow, Despite Critics

Officials in the Federal Bureau of Investigation have been pushing for more than a year to expand the agency's computerized data bank network by linking it to existing state and local criminal information systems.

The Bureau's plan is to establish a centralized data system that would supply information to local police authorities, but which could also monitor and collect all local and state police messages. Control of communications would rest with the F.B.I.

That is what alarms so many of the critics. Conservative members of Congress are apprehensive about creation of a Federal police force; liberals are fearful of possible misuse of information at the expense of individual rights.

Responding to the criticism, officials have written that "The F.B.I. has long recognized . . . the sanctity of the privacy of the individual." Authority to halt the computerized police system is vested in the Attorney General, the White House, and the Congress. A definitive action has not been taken.

The New York Times

New Role for NCIC

Financial institutions, plagued by phony securities deals, can get some extra help from the FBI's National Crime Information Center. Before leaving his post as Attorney General, William B. Saxbe urged the financial community to make better use of the NCIC to report lost, missing, counterfeit and stolen securities.

NCIC's fleet of crime-watching computers, Saxbe said, can also be used to check out suspicious securities. Approximately 90 per cent of the country, he pointed out, can have access to the network through local and federal law enforcement agencies for validation purposes.

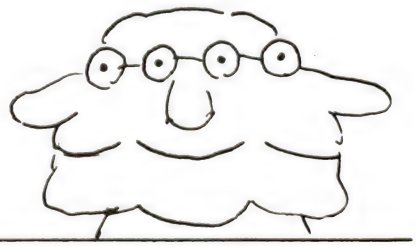
In areas where there's an overload of law enforcement traffic, Saxbe said, the Justice Department could allow a financial user direct inquiry access into NCIC's securities file "as long as adequate internal security procedures are worked out."

Correlation and Causation

A professor of statistics used the following example to show that a statistical correlation between two series of events does not necessarily establish a causative link.

"Just because smoking of cigarettes and lung cancer are correlated," said the professor, "does not of itself prove that smoking causes cancer. Of course, the medical profession are agreed that there is indeed a direct causative link between the two, but the statistical correlation itself does not prove it."

"You may have noticed," he continued, "that the front seats of the vaudeville are always filled with bald-headed men. Now, if you believe that smoking causes cancer because the two are correlated you would conclude that looking at girls in tights makes your hair drop out. In fact, it is the over-activity of a certain hormone which both makes your hair drop out and makes you want to look at girls in tights."



You Can't Escape UPC

Recently, mysterious little squares filled with green, gray, and black stripes have been appearing on boxes of cereal, cans of spaghetti, and other supermarket items. These little squares belong to the new Universal Product Code (UPC) scanning checkout system, and they will increase checkout speed and efficiency in supermarkets and department stores.

The checker simply passes the UPC symbol over a slot in the counter, and it is read by an optical reflective system which uses a lasar light source. This symbol can contain information such as the item's department, manufacturer, color, and size. This information is then decoded and transmitted to the in-store computer which recalls the price from memory and sends it to the register for display and printing on the sales receipt.

Not only does the UPC scanning system check out merchandise, it also records information for inventory, calculates sales taxes automatically, records amounts of tender given, displays amounts of change due, calculates employee discounts, authorizes checks and charge accounts, and forces the salesperson to insert a saleschecк when needed. One such scanning system operates in conjunction with NCR 255 electronic checkout terminals and an NCR 726 in-store computer and is priced at $4995.00.

This system is easily programmed, and modular and expandable hardware makes the Terminal Support System easily adaptable to a store's needs. Human error in merchandise management will practically be eliminated by NCR's small green, gray and black squares.

What? A Computer Make a Misteak?

Believe it or not, computers do make mistakes; in fact, the Rome Air Development Center at Griffiss Air Force Base has given a $408,000 grant to the Polytechnic Institute of New York to do research on computer errors. The research program is aimed at predicting the number and frequency of software errors made by Air Force computers, and hopefully, it will result in the formulation of techniques to prevent and eliminate mistakes. If successful, it is expected that other industries will use the report as a guide for their own studies.

The Air Force spends millions of dollars each year on correction of programming errors. Some of these programs are several million instructions long and are programmed by hundreds of individual programmers, each writing a small module of code. When these codes are connected, mistakes appear because modules are tested individually, not collectively. The real problem in producing reliable software has been in predicting how often the software will fail when put in use. Some large time-sharing computers fail every few hours due to software problems, while others operate for weeks without failure. The Polytechnic team will conduct studies on techniques for more reliably testing large programs.

Want to Lose 10 Pounds?

Do you think that your weekly grocery bill is too high? Have you been eating the right foods? Have you been eating too much meat and not enough vegetables? A UNIVAC 1108 computer will answer these and other questions you have about food and your diet.

Over 12,000 Wisconsin residents have already taken advantage of the program offered by the University of Wisconsin in Madison. One simply fills out a food record which shows foods most frequently eaten by Wisconsin residents. A person may fill out one to thirty forms; each form is for one day.

The results are then checked by nutrition experts, and food substitutions or diet changes may be recommended. These recommendations are based on the person's intake of a dozen nutrients, taking into consideration the person's age and sex. The computer has shown that many people eat more meat than they need; these people could cut back on meat and buy less expensive foods.

"One with Pepperoni and Mushrooms Please"

Michigan State University's "talking computer" recently ordered pepperoni and mushroom pizzas from a local pizzeria and received them. The order was placed under the direction of a wheelchair-bound and speech-handicapped student, who operated the keyboard to make the computer talk over the phone. The student was one of twenty-five guests at the pizza party for beneficiaries, supporters, and co-workers in the project to adapt the computers to help people with speech problems. Host of the party was Dr. John Eulenburg, professor of linguistics and computer science, and co-designer of the talking computer.

Computers Monitor Biorhythms

Everyone has those days when they seem to be extra accident prone. One is constantly dropping things, stubbing toes, crunching fingers, and making petty mistakes at work. United Air Lines' San Francisco aircraft maintenance base is using computers to discover these accident prone days by monitoring the biorhythms of more than 28,000 employees; hopefully, the study will help reduce on-the-job accidents.

Biorhythms are the physical, mental, and emotional ups and downs of an individual, and they can be plotted in regular cycles. The physical cycle repeats every twenty-three days, the emotional every twenty-eight days, and the intellectual every thirty-three days. Studies show that individuals have more accidents when their biorhythms are on a negative curve. In United's program, each foreman is given a chart of each employee's "zero," "double zero," and "triple zero" days. (A "double zero" days occurs when two cycles are in a downphase.) Employees can then be alerted to be extra cautious on those days.

On-Line Legal Data

SEARCH (System for Electronic Analysis and Retrieval of Criminal History), a federal project which stresses computerization of court records, is going to be a part of the New Jersey legal system. A central computer storing every court decision since 1948 will give all courthouses and law libraries in the state access to the materials filed in the computer. Legal data will be available swiftly on a full-text basis, so that the time-consuming tasks of research can be accomplished with a simple push of the computer button.

Computer Security Puzzle

By concocting what could probably qualify as a code breaker's nightmare, one researcher hopes to prevent some of the criminal manipulations that go on with computers. Professor John Robinson of the University of Iowa is hard at work making a computer puzzle-code of data bits that must be run before any program can be used. For a less valuable program, he says, an operator might have to take about 1200 data bits and arrange them correctly to have access to the program. To further complicate the task and minimize tampering, he would include an extra 200 useless data bits. In a more complicated program, a computer crook might be faced with picking the right 2000 data bits out of a possible 10,000 clues and somehow figuring out the correct arrangement. That's certainly enough to discourage lucky guessers.

Science Digest

Graphical Standards for BASIC

Because there are no standards for writing graphical programs, it has always been difficult for people and institutions to exchange written programs. However, the development of a standard syntax for graphical operations in the BASIC language is now underway at Dartmouth College. The study has been made possible by grants from the National Science Foundation, the National Bureau of Standards, California Computer Products, Inc., Hewlett-Packard Company, UNIVAC, and Tektronix.

The project began in October, 1974 when a panel met at Dartmouth to discuss extending BASIC for graphical purposes. If the resulting syntax is approved by the X3J2 Committee on Standard BASIC, graphical commands could be incorporated in the published standard. However, the X3J2 has been holding sessions for over a year without resolving all the differences of the committee members; so, it appears that the graphical syntax project will not enjoy the benefit of even a preliminary language standard before it is scheduled to terminate in January, 1976.

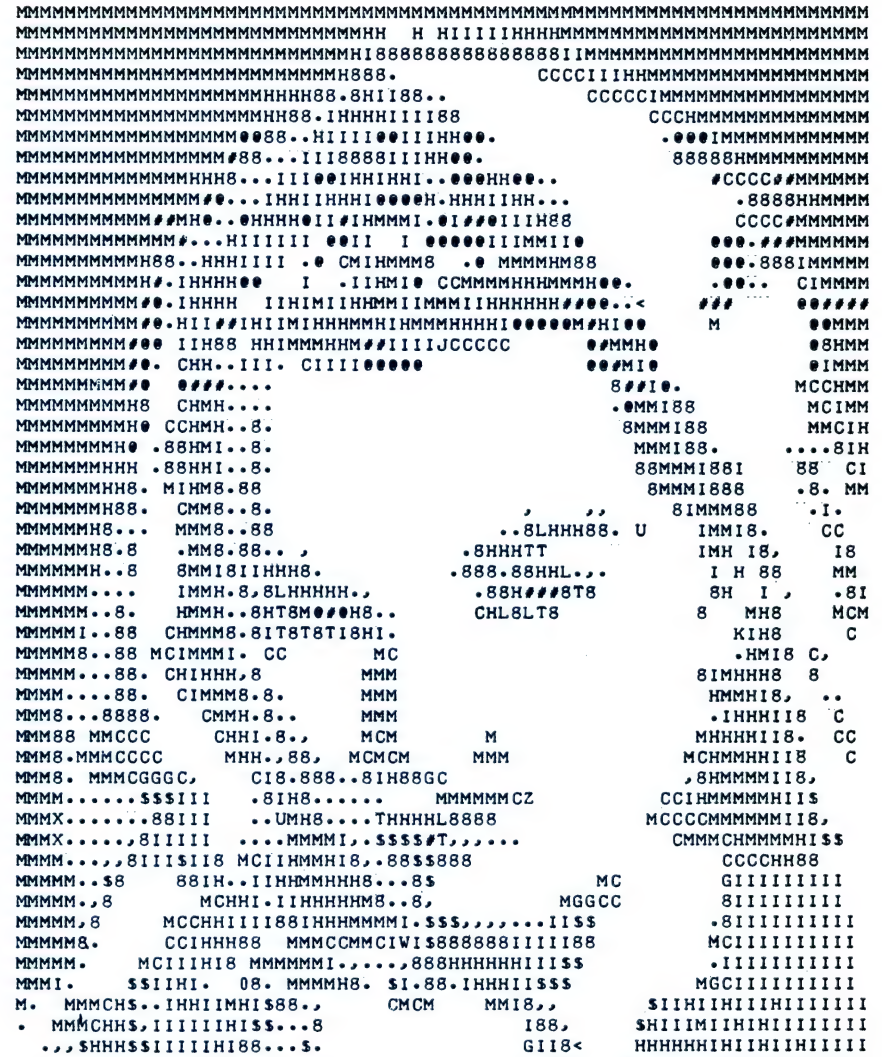
Indian Students Use Computers

Educationally delayed teen-aged American Indian students from four states are being given a chance to further their education with the help of a timesharing computer system. Chemawa Indian School of Salem, Oregon has purchased extensive computer time from the Oregan Total Information System (OTIS), an educational computer consortium in Eugene. The school, founded in 1883, is the oldest continuously operated Indian boarding school in America, providing dormitory living during the school year to high school aged children from tribes in Alaska, Oregon, Washington and Idaho.

The computer time will provide each student who is more than three years below his grade level with a system of learning laboratories focused around terminals and computer assisted instruction. The minicomputer directing this instruction will be a Hewlett-Packard 2000F, the third in OTIS' inventory.

According to Dr. Y.T. Witherspoon, special projects coordinator for the School, 16 terminals will be divided among three separate learning labs for reading, language arts and mathematics. "Students will use the lab that answers their own particular need. We will be able to give each youngster 10 minutes per day on a terminal and still meet the educational demands of the entire student body."

"It is our hope," continued Dr. Witherspoon, "that by using the Computer Assisted Instruction, we will be able to compress at least seven years of education into the usual four – thereby giving educationally delayed students a chance to catch-up with their contemporaries."



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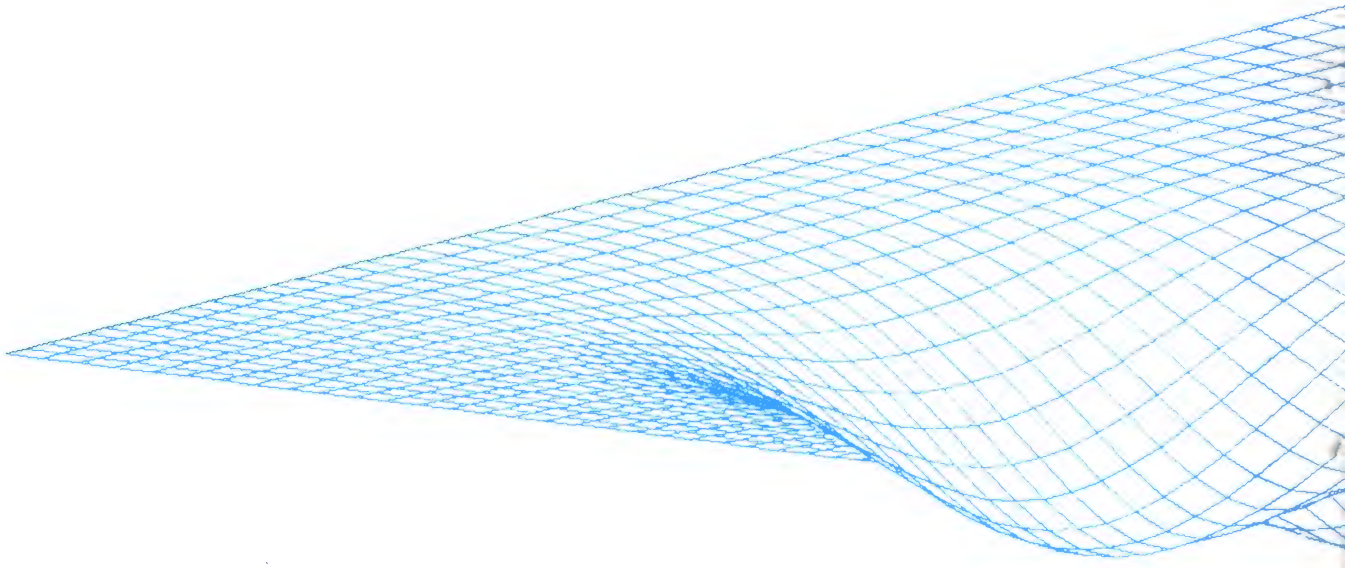

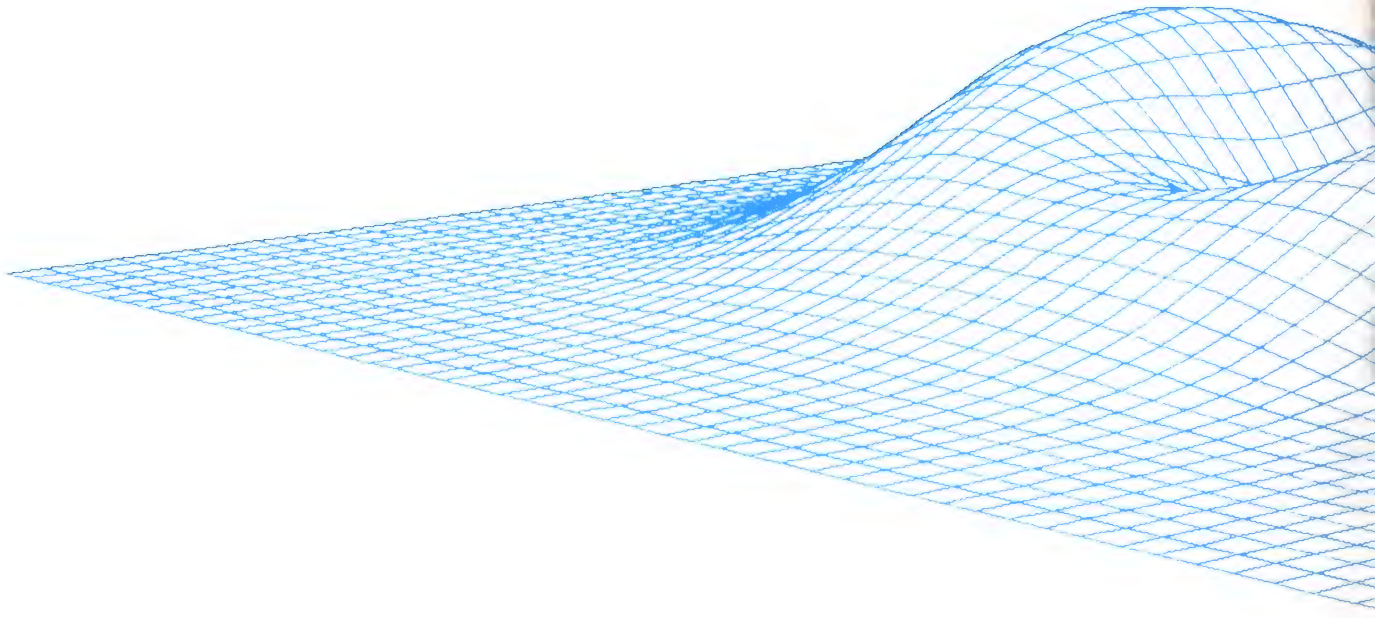

Computing

"Undulating Surfaces"
by George Chaikin

Poems by Peter Payack

MOTORCYCLE EVOLUTION

The size of the human brain
increased from the apelike
capacity of 500 cubic centimeters
in Australopithecus to about
1500 cc. in modern man.

It took 2 million years
for man's brain to evolve
from the motor size of
a Kawasaki 500 to that
of a Harley-Davidson Superglide.

ONLY MINUTES

It would take
an infinite number
of monkeys,
an infinite amount
of time to write
this poem using
typewriters and
random chance.

For instance,
it would take 10,000
monkeys 150 years
to achieve one "it would".

As it was,
it took this goofball
only minutes.

INTERSTELLAR CHESS

If in the cosmic
struggle for existence
even entire galaxies
are mere pawns,

(1. Andromeda - King 4...)

Then who are the players,
and what is the prize?

(...Milky Way - King 3).

THE AVERAGE PERSON

Every second,
the average person
has 100 million
sensations bombarding
his body like so many
telephone messages,
with his head acting
as a switch board to sort
out the data.

When you read this poem
do you sort of get
a busy signal?

CORNUCOPIA

There are 100,000
million billion stars
in the known universe.

If one in a trillion
has a planet with intelligent
life on it, there would be
100 million sentient races.

The odds are
that somebody out there
has to like my
poetry.

That's why
I keep writing.

ONLY ME

The only thing
between my shadow
and the sun
for 93 million miles
is me.

I'm always
getting in the way
of something.

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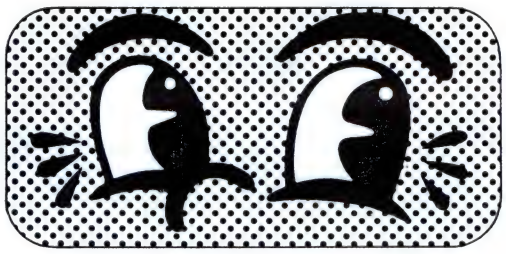

Notices, etc.

GAMES EDITORS PLAY

You may have noticed there are no computer games in this issue. You may well be wondering, "Why does the leading computer games magazine have no games?" The answer is simply this: the next issue (Jan-Feb) will be COMPUTER GAMES AND PUZZLES COVER TO COVER! Hence, we didn't run any games in this issue.

While the all games issue will be "locked up" by the time you read this, if you want to submit a game for a future issue, send us a listing and two sample runs in dark black ink (change the ribbon on the TTY) on white paper (not yellow, gray, etc.). Also send a writeup (typed, double spaced). It's not necessary to send a paper tape, but if you do, wrap it in plastic kitchen wrap (otherwise the oil seeps out and ruins the other material in the envelope). If you want an acknowledgment, send a self-addressed stamped envelope.

OUR FACE IS RED DEPARTMENT

We inadvertently failed to mention that the computer game REVERSE (Sep-Oct issue, page 58) was originally written by Peter Sessions of People's Computer Company. Sorry!

RENEW NOW!!

Some absolutely FANTASTIC stuff is coming up in Volume 2 of *Creative Computing*. One issue will be entirely devoted to games and puzzles, another to artificial intelligence and future computers, still another to the computer in language arts.

Also, all subscribers will receive in place of the May-Jun 76 issue, a fabulous, full color book "Computer Artists on Computer Art." The bookstore price will be at least $5.95, but subscribers will receive this at no extra cost as part of their subscription!

HAVING A MATH/COMPUTER/SCIENCE FAIR? WANT TO MAKE SOME MONEY?

You can sell copies of *Creative Computing* at your next math/computer/science/other fair, conference, or club meeting. Simply send us an order for bulk copies. Be sure to mention that it is for a school or non-profit organization, and you get a 50% discount off the $1.50 cover price. (Bookstores and commercial resalers get a 40% discount.) Please note: 1) Minimum order 25 copies, 2) Order at least 4 weeks in advance to allow enough shipping time, 3) Include your payment (75¢ x number of copies plus $1.00 for shipping). We can generally supply copies of the current and one previous issue in any mixture. At fairs where this has been done, they have sold quantities ranging between 32 and 290 copies (and the students have earned from $24 to $217).

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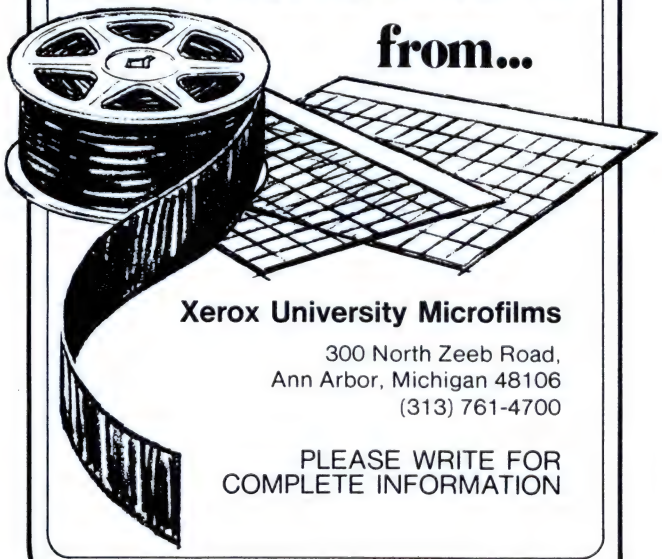

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Monty Python meets Monte Cristo or **French Disconnection**

Robert P. Taylor
Teachers College, Columbia University

A final panel discussion at 5 p.m. on Friday, September 5th (a session unfortunately not recorded in the two-volume proceedings) really summarized the essence of the IFIP 2nd WORLD CONFERENCE ON COMPUTERS IN EDUCATION (WCCE II). I will therefore emphasize that session in this report and leave to other reporters the task of issuing a more academic, comprehensive summary of the conference.

The first panelist, an Englishman, suggested that at WCCE II he had discovered where Monty Python's creators got their inspiration. He believed they must certainly have attended some earlier, unrecorded IFIP conference in Marseille. Such wildly surrealistic arrangements as those at WCCE II, he maintained, were simply too much like Monty Python skits for one to assume anything but that Monty's creators had been through a similar conference: no water, electricity, or food initially available at the Luminy campus accommodation when hundreds of delegates began arriving on Sunday night; transport to meeting site in busses which broke down only to move when the drivers got out to see what was wrong; transparency projectors which either didn't project or which shocked those who tried to adjust them; mandates against reading papers from the podium even for the first meeting though no one could possibly have had time to familiarize himself with the papers being presented; galas and receptions of questionable distinction; ostensibly spectacular outings to what turned out to be quite insignificant spots; heavy rains in a city normally noted for its dry climate; and so on. Some attendees, the Englishman noted, might mistake this stupendous accumulation of the bizarre as chance, but no keen follower of Monty Python could make such a mistake. The parallel between such an accumulation at WCCE II and the well-planned chaos which is standard fare on Monty Python's Flying Circus is too striking to be overlooked. "To have thus discovered the roots of dear old Monty," he concluded, " . . . ah, that alone made this a conference I shall not soon forget."

The next panelist at this end-all session, an American expert on computer-generated animation, interpreted the whole thing cinematically. He maintained that WCCE II should have been filmed and distributed – as *French Disconnection*! The American then elaborated on the parallels and contrasts between such a film and the currently popular *French Connection II*. He stressed three obvious parallels in the two dramas – (1) the Marseille setting; (2) the odd reception accorded the visiting hero(es); and (3) the scenes of wasteful chaos with which each drama begins. He claimed that significant contrasts were just as striking and numerous. As illustration he commented briefly on (1) torture of the hero(es) and (2) dramatic climax. He noted that while torture was intense and centered on a single victim in *French Connection II*, torture was mild and distributed across hundreds in *French Disconnection*. About climax, he had this to say: "French Connection II had a terrific climax – the shooting right at the end, while this thing . . . why this thing just petered out, dried up. There wasn't any climax at all!"

The final panelist*, a European with a slightly German accent, focused attention on the classics. Recalling *le Compte de Monte Cristo*, this panelist had, the evening before, paid a visit to le chateau d'If, the island prison which Dumas had used for the setting of *Monte Cristo*. Upon completing that visit, she said she sensed that our hosts for WCCE II had made an enormous *faux pas*: they had chosen the wrong site for delegate housing. Upon sailing back to Marseille from the visit, she realized that the stout towers and rocky cliffs of the prison island would have made a far more classic (and remote and inaccessible) accommodation than the Luminy campus chosen by the conference organizers. "Why," she pointed out, "one could actually *walk* in from Luminy if one were really desperate. It's a mere ten or twelve kilometers. But the chateau d'If, well . . . one can't walk in from there, can one?"

On this point, one of greater clarity than many points made at WCCE II, the final panel session ended. The panelists gathered up their baggage, left the lobby, and labored down the winding drive to catch a special IFIPS chartered bus for the Gare St. Charles. They boarded the first bus at the bottom of the drive, then disembarked and entered a second bus. (The first one was probably going back to Luminy.) Eventually the second bus pulled away and disappeared up the road in the direction of the train station. If it was anything like the other IFIPS busses at WCCE II, those panelists missed their train. The bus either broke down or went to the wrong place.

Does my presentation of this final panel session imply this was a bad conference? No, merely that there were some real problems. Once one gets beyond some of the unique flaws of WCCE II (and humor helps), one sees that it probably wasn't such a bad conference after all (it had to be good . . . why else would I have spent so much to go). There were over 1000 attendees representing both developed and developing countries around the world and over 150 papers (rather completely presented in the proceedings), covering a wide range of topics with a wide range of sophistication. One learned (or relearned) that some of the problems one thinks are unique to one's own shop (or city or country) are really rather universal problems inevitably tied to the rapid growth of computing and education for computing: there is still no perfect way to teach programming; no ideal language has yet been discovered; a gap exists world-wide between academic or scientific computing and data processing; and everyone everywhere is beginning to face the computing literacy problem confronting the masses.

Probably no one during the conference digested even a quarter of what was presented or what was written in the proceedings. Perhaps few attendees will do so even after returning home. Some papers will probably never be read or looked at again and many will be only glanced at. A select few, though, will certainly be read carefully by many people in various countries. The substance of those papers and the experience of meeting so many people with common interest in the present and future of computers in education merged to make WCCE II a rare experience.

Was it really unforgettable? Certainly. Was it worth it? Who can say – for some, definitely; for others, possibly; for still others, probably not. Would the average attendee go again knowing beforehand exactly what it would be like? Who can say? I think I would.

(This report is appearing simultaneously in *SIGCUE Bulletin.*)

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*A fourth panelist was invited but did not attend because his bus went to the wrong place. The following is a summary of his comments.

Getting there is half the fun! The conference started on September 1, thereby forcing peoply to fly to France in August while peak fares were still in effect. A one-day later starting date could have saved the U. S. attendees some *$30,000* in air fares. Participants were promised a 20% reduction on their return railroad trip if they flew into a city other than Marseilles (I came by way of Frankfurt). However, this discount was actually a myth due to the incorrect translation of instructions for its use into English.

But once there, the fun continued. Conference lunches

Continued page 43, Column 2.

IFIP 2ème Conférence Internationale " INFORMATIQUE et ENSEIGNEMENT "

An Interview with J. Hebenstreit, Conference Chairman

HEBENSTREIT. We observe that the great majority of papers look at computers as a replacement for current teaching methods. This is valuable in that the methodology of informatics may cause us to re-analyze what teaching and learning is and what it should be. *We cannot continue to teach the way we have been and are currently.* How can we expect children to continue to memorize in light of the information explosion? The accumulated knowledge of humanity is doubling every 13 years. There is an upper limit to the time an individual can spend in learning and also to the speed of learning. But the amount of knowledge has no upper limit. What then, is the solution?

The best approach appears to be to give the individual a model of his environment, or a portion of it; and then train people to extend and build their own models. These models, or simulations are not meant to teach model-building, but rather other subjects. We see a definite trend toward more papers in this area. Computers are being used less in a mechanical sense and more to affect the pedagogy of teaching and learning.

I want to emphasize a very important point: the way to use the computer, when to use it, and how to use it is the responsibility of the teacher. Solely. Totally. This is never the responsibility of the computer scientist.

QUESTION. What about teacher resistance to computers?

HEBENSTREIT. Unfortunately teaching is not only a profession but a bureaucracy. The attitude is, "I've got enough problems. Don't bother me with new things". However, the learning of nearby, non-threatening disciplines introduces interdisciplinary learning and it seems to work. In other words, "I can use a computer model to illustrate my point nicely, but I'd like to really know how it works (statistics, etc.) and I'd like to be able to modify and extend it (programming, data structure, etc.).

QUESTION. What's coming?

HEBENSTREIT. Cheap, off-line devices. Telecommunications costs are high and will remain so, hence microprocessors and MOS technology will be the heart of educational computers in the near future (5—10 years). While generally stand-alone, from time to time these devices may be connected to large computers or data banks.

QUESTION. When is the next world Computers in Education Conference?

HEBENSTREIT. Probably 1981. As of this time no country or sponsoring organization has been selected. We're seeking volunteers. It's quite a massive job — this conference had over 1,000 attendees from 50 countries.

CONFERENCE REPORTS

The official 2-volume (over 1000 pages) IFIP World Computers in Education Conference Proceedings were published by North Holland/American Elsevier, 52 Vanderbilt Ave., New York, NY 10017. Price unknown (probably high).

A computerized data base of authors, subjects and keywords from the papers has been prepared by Phil Barker. A report of this (Report 7504) and an excerpt from the report are available from P. G. Barker, Dept. of Computing, University of Durham, Science Labs, South Road, Durham DH1 3LE, England.

IFIP PHOTOS

I paid an outrageous price for rapid processing of a number of photos from the IFIP Conference. If you read *Monty Python* . . . you shouldn't be surprised that there are no photos with this article and a certain Marseilles photographer is probably laughing at a gullible American editor.

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at the 1976 National Computer Conference
June 7-10, 1976
New York Coliseum

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Monty Python footnote con't.
were outrageously priced at $5.00 each and required waiting in a queue for 15 to 60 minutes just to get in. The "gala evening" was a gala ripoff costing $22.50 per person; this buffet/folkloric festival 1) was held in a gravel pit mislabeled a garden, 2) ran out of beef and shellfish but had plenty of thick crusted, soggy pizza, 3) had a display of singing and dancing which could be seen only by those who shoved their way to the front row, 4) had no chairs or place to sit, save on the gravel, and 5) was typical of the local arrangements in general.

One must sincerely hope that future conferences would not be organized by sadists, held at a school with no interest in the subject (Faculty of Medicine), in a city with little interest in visitors (Marseilles). Why, Big Apple (Fun City) would even be better!

The Computer. Threat to Society?

An Interview with Senator John V. Tunney

Senator John V. Tunney of California has long taken a major interest in the protection of individual rights and has continually proposed legislation to meet these goals. He is currently Chairman of the Subcommittee on Constitutional Rights of the U.S. Senate Committee on the Judiciary, and also the Subcommittee on Science and Technology. Senator Tunney recently took time from his busy schedule to respond to some questions posed by Creative Computing.

CREATIVE COMPUTING. On one hand the computer is a powerful tool for extending man's intellect. On the other, it is a monstrous dehumanizing force. Which will prevail? Why?

TUNNEY. Obviously, the computer has an enormous ability to make our lives more rational and convenient. In industry after industry, the arrival of the computer has facilitated the provision of services on a scale that was beyond imagination only a few years ago. Yet many Americans are concerned, quite rightly in my opinion, that the technological imperatives that flow from the rapid spread of large computers and telecommunications networks will gradually overwhelm traditional democratic values, leading ultimately to the loss of individual autonomy and the concentration of extraordinary power in anonymous and unresponsive bureaucracies. Congress seems to be aware of these dangers, which are so reminiscent of the nightmare visions of Kafka and Orwell. If the current level of Congressional concern remains constant, then the American people stand a good chance of gaining control over the powerful technologies of computer science.

CREATIVE COMPUTING. Large data banks of credit rating information are one of the most visible "computer threats" to individual privacy. Yet these data banks have probably prevented millions of dollars of fraud and stopped thousands of people from going into debt beyond their ability to pay. Is this a worthwhile use of computers or does the possibility of misuse outweigh the benefits?

TUNNEY. Few will complain about the inclusion of objective "ledger" information about a person's financial history in a computer databank. However, any attempts to computerize subjective opinions about an individual's personal habits raise substantial doubts. The computer's phenomenal speed, availability, efficiency, convenience, low cost and long-distance capabilities all combine to pose serious questions about our present ability to protect innocent citizens from the devastating and lasting consequences of inaccurate or malicious information.

CREATIVE COMPUTING. Most computer errors are actually human errors in programming the computer. These are commonly referred to as "bugs". It is a rare program that doesn't have some bugs even after years of successful operation (the routine with the bug may be very infrequently used or a small error in a complex set of calculations may not be recongized). Most pathology departments in large hospitals use computers for analysis and diagnosis today. Would you feel comfortably in such a hospital suspecting you had recently picked up an unusual disease from the Far East?

TUNNEY. I would feel comfortable in such circumstances if I could be assured that the computer would serve only in an assisting role and not become a substitute for the doctor's professional judgment.

CREATIVE COMPUTING. In one sense a computer is a tool just like a hammer or lathe. But a very powerful tool that can replace low-skill jobs. Do you think computers will create as many jobs as they eliminate? Will the new jobs require specialized training? If so, will people who have lost their job to a computer be able to get such training? Will they be willing?

TUNNEY. I think it is logical to conclude that in the long run the computer industry will create as many jobs as it displaces. However, it seems equally logical to assume that particular individuals who lose their jobs because of automation will not necessarily be able to find another in a computer-related industry. Obviously, some kind of re-training is advisable.

CREATIVE COMPUTING. From small-sample public opinion surveys, computers have been programmed to predict the outcome of entire elections. Do you feel that such predictions unduly influence the actual voter later on?

TUNNEY. No, I do not believe that early predictions necessarily affect the outcome of elections.

CREATIVE COMPUTING. By making projections from early-reporting precincts, computers predict on TV the outcome of elections long before all the ballots are cast on the West Coast, Alaska and Hawaii. Do you think voters in these areas are unfairly influenced by these predictions?

TUNNEY. In Presidential elections I do not believe that computerized projections should be announced until all polls have closed. In 1964 and 1972, for example, I believe that voters in the West, after hearing projections of Presidential landslides lost interest and didn't vote. This absenteeism especially affects statewide and local races and issues.

CREATIVE COMPUTING. High School students have repeatedly cracked the passwords and access codes of timesharing computer systems thereby demonstrating that the most secure computer systems are not at all secure. How do you feel about the fact that research on some of our most advanced military systems is done on the ARPA computer network to which thousands of college students also have access? (Educational users supposedly do not have access to research accounts but –)

TUNNEY. I have been assured by Defense Department officials in hearings before my Judiciary Subcommittee on Constitutional Rights and my Commerce Subcommittee on Science and Technology that ARPANET is not used for classified work. If that testimony is incorrect, then I am greatly concerned.

CREATIVE COMPUTING. We have no information that classified work per se is being done on the ARPANET; the point we were trying to make is that there is no such thing as an absolutely foolproof, secure computer system.

One last question – do you feel that the functions and applications of computers are beyond the understanding of the average individual?

TUNNEY. Any reasonably informed person can understand computer functions and applications if they are explained in plain English. Unfortunately, computer specialists are like all professionals and tend to cloud their explanations with opaque jargon.

CREATIVE COMPUTING. One of our goals is to cut through this jargon and to bring facts and information about computers to students and, indeed, to people in all walks of life.

TUNNEY. Thank you for devoting so much time and consideration to these matters and thank you also for the opportunity to contribute to *Creative Computing.*

CREATIVE COMPUTING. Thank you Senator Tunney.

Putting Teeth Into Privacy Legislation

by Susan Hastings

H. R. 1984 — that's the apt number a computer has assigned to the new Koch-Goldwater proposal that would expand the 1974 Right to Privacy Act. The new bill is designed to correct many of the ambiguities and weaknesses of the first successful legislation for protecting the privacy of individuals on whom personal information is held in federal government data banks.

Public concern with the government's relentless appetite for more and more information about the people it serves has grown with the Watergate disclosures and the recent revelations about CIA and FBI dossier-building. People who formerly were only peripherally aware of the problem, are now joining the crusade against privacy invasion partly because they see the computer, and the data it is capable of storing, as a terrible threat to their right to privacy. They don't like the idea that somewhere, somehow, files are being kept on them; that there are clerks who know about them, and can reach into those files and do things against them.

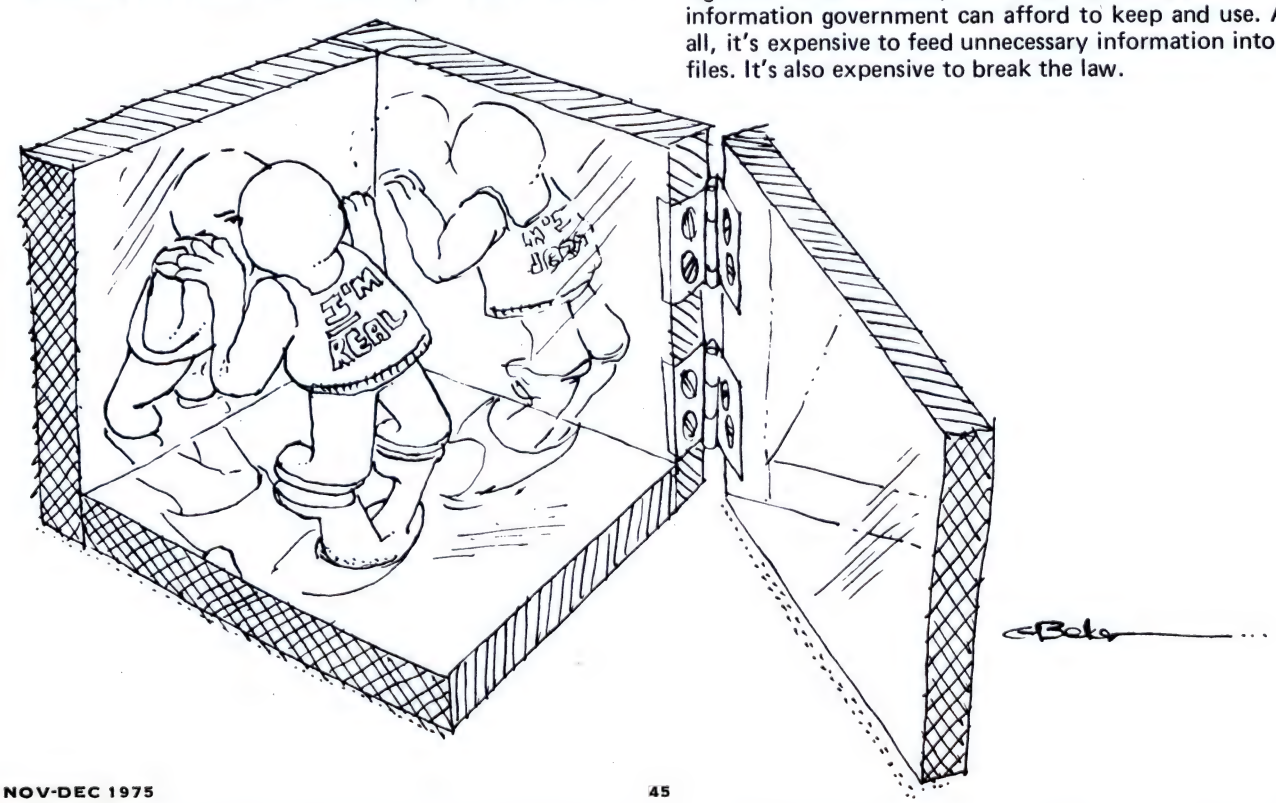
The new law is not perfect, but as Willis H. Ware, chairman of a presidential commission appointed to study the implications of privacy legislation, admits, it's adequate "as a first whack at the problem." Major criticism is directed at what the law has omitted, and conversely, at the prohibitive expense of implementing just what it does include.

Privacy legislation does not prohibit the government from keeping data banks, but it does protect the individual on whom the information has been kept from wanton disclosure of that information. The present law covers most personal information systems operated by federal agencies; the new bill would extend legislation to cover state and local governments as well as the private sector. Under it, subjects of data to be released usually must be aware of the nature, the purpose, and the recipient of the information to be disclosed, and should, in most cases, be able to rule on its accuracy and relevancy. Implementation of the law will be costly: the Office of Management and Budget estimates expenses of $200 to $300 million a year for the first four or five years after a startup cost of $100 million. And that is just for the law as it now stands. People seeking continued privacy legislation want it to cover data in the files of many agencies that are exempt in current and pending legislation, i.e., law enforcement, intelligence and certain personnel records. But these people do have hope for continued legislation, and will continue their battle for new laws, even if they do have to see them passed separately.

The American Civil Liberties Union is one extra-governmental group that has worked long and hard for privacy legislation, and it is generally pleased with Congressional response. Ironically, Aryeh Neier, ACLU executive director, gives praise for the victory to the computer itself. Today's fear about computers and invasion of privacy has had a very beneficial impact, he says, because "it created an awareness of the possible danger" for everyone.

Neier believes that the computer, although it "may make it a little bit easier to invade privacy", was never the real villain in the personal information game. The technology for managing data banks had achieved a significant enough development before computers came along to create the problem without computers. Before the computer came along, information that was fed into the information files was actually of a more gossipy nature than the harder kind that the computer is fit to handle. But people were more scared about the power of a machine than they ever were about the real culprits — the people who collect the information to use against other people.

Government will probably always insist on keeping records about its citizens. Perhaps though, new privacy legislation and the computer that inspired it, will limit the information government can afford to keep and use. After all, it's expensive to feed unnecessary information into data files. It's also expensive to break the law.



Industry Leaders Testify at Government Privacy Hearings

by Susan Hastings

In an era in which technology constantly provides people with newer and more useful tools, a decision must be reached on how the information provided by technology should be used by society. In hearings before the U. S. House of Representatives last winter, business leaders in the computer field attempted first to define the issues of computer security and privacy, and then to demonstrate the roles government and industry must play in their efforts to make the new technology beneficial to all of society.

There is a great difference between the terms "privacy" and "security". Privacy is — or should be — the inherent and legal right of individuals, groups or institutions to determine for themselves when, how, and what information about them is communicated to others. In relation to computers, security is the means taken to ensure that privacy. Privacy is a legal, political and philosophical concept, and properly belongs in the domain of government. Computer security deals with technique, and is the province of the manufacturer. Law and technology must cooperate in their efforts to make the benefits of modern electronics available to everyone.

Rapid progress in electronics has raised the processes of data collection, storage, retrieval and dissemination to the point where it will be easier to invade the privacy of citizens. Although continuing progress makes it possible to develop systems designs and controlling software that provide much better protection against man or machine failure, business must take upon itself the task of developing even newer systems to protect the rights of the individual.

Separate computer privacy studies in the United States, England, and Canada have agreed upon four recommendations for legal and technological control over systems as they relate to sensitive information about people:

1) An individual should be given right of access to information about him contained in record keeping systems and a way to find out how the information is used;
2) There should be a way for an individual to correct or amend a record of identifiable information about him;
3) There should be a way for an individual to prevent information about him that he provided for one purpose from being used for another without his consent;
4) The custodian of data files containing sensitive information has a responsibility for endeavoring to maintain the reliability of the data and to take precautions to prevent misuse of data.

The manufacturer is faced with the technological problem of implementing these recommendations. His chief responsibility is to provide the hardware and software that will enable computer users to achieve the degree of security necessary to insure the accuracy and pertinence of personal information held in data files. Although all manufacturers recognize that technology alone cannot prevent the abuse of information by authorized persons, it can provide for journaling and auditing techniques which may serve as effective deterrents. IBM's policy on data security would no doubt hold for the entire industry:

"Although the customer has overall responsibility for the protection of data, IBM has a responsibility to assist our customers in achieving the data security they require. In this regard, IBM will offer systems, products, services, and counsel that clearly contribute to the solution of data security problems."

The objective of any data security program is to cut the risk and probability of loss to the lowest affordable level and to implement a full recovery program if a loss occurs. Lewis M. Branscomb of IBM and Robert P. Henderson of Honeywell believe that their companies have recognized their responsibilities for providing better safeguards for computer security. In 1972 IBM committed itself to an investment of some $40 million over a five year period to study the requirements of data security and to make further developments of appropriate safeguards of their products. Like Honeywell and other manufacturers, they are working on devices in the hardware and software areas that will provide protection in the security area.

Despite ever more sophisticated technology to increase the security of computer systems, there is no such thing as *perfect* security. Beyond legal action, there is a great deal that users can do, however, to promote their own security. Users must be educated to take the responsibility of determining their own security needs and selecting the right combination of operating procedures, physical security measures, hardware devices, and programming tools that will fill those needs. Historically, the security of any information system depends on normal procedures of business and accounting control and traditional physical security measures. A computer installed behind showplace plate glass windows may be good for a company's public image, but it renders the computer vulnerable to people with malicious designs. Likewise, users should exercise a special sensitivity in selecting the personnel who have access to data banks, for no matter how secure the system, there is always the danger of people being compromised. Trained, dependable people are an absolute necessity. No matter what the level of hardware and software security, one must always remember that people run (and break) the system, not technology.

Record-keeping in the Space Age

Robert P. Henderson

People persist in tagging our era the "Space Age," but perhaps "Computer Age" is a much more meaningful term to describe it. Certainly the exploration of space excites the imagination, but the computer exerts a more compelling influence on the life of the average citizen. There wouldn't even be any space program without the technological advances of computers. And because the computer's potential effects on society are so great, it has generated a good deal of controversy.

The computer has come along to serve as an extension of man's intellect just when it is most needed to help solve many of the complex social and economic problems of our time. But there are those people who, after thoughtful consideration, see the computer as facilitating a radical realignment of knowledge — and therefore of power.

The new sort of computerized power politics is a dangerous possibility, but it is not inevitable. Great benefits lay ahead of us through the use of computers; we must take steps to prevent the perversion of computer technology and insure ourselves that the computer always serves the individual and never the other way around.

In their potential benefit to society, computers today are ready to take off in a big way. In the past, a great deal of effort has been directed toward making the most efficient use of computers as they existed, but now managers must think of developing computer systems that are specifically geared to their needs and the needs of the people who work for them. Information systems must be developed that will help managers make decisions, thus making business more efficient and effective.

As the isolated and independent computer systems so typical of the last decade become linked together in the 70's, data and programs will begin to flow together in enormous national — and even international — data grids. One of the great benefits of these large new computer systems will be their ready access to many people in both a physical and intellectual way. Terminal devices through which people can communicate with the computer systems will enable them to converse with the data bank as easily and familiarly as with their human colleagues. In effect, each man will be able to use the computer as a means of building upon the work of others. Just as he will use data generated by the activities of others, he can generate his own data for their use. The result can be an eventual pyramiding of man's knowledge and intellectual accomplishment that is staggering to consider. There are those who even forsee a time when all of the information available in the world can be stored and constantly updated in computer memory, available to anyone who wanted it wherever he might be.

In the future, vast compuerized legal files could produce case histories quickly and easily for all lawyers. The result might be not only clearer and easier interpretation of laws, but quicker and less expensive justice. Computers could aid doctors in making patient diagnoses, and make medical information about individual patients available wherever that patient might happen to be when he suffers an accident or illness. Computerized educational systems may help teachers satisfy the individual needs of each student in their classes, and give the teachers more time to give direct help when required. In all of these cases, computers will not be replacing people; they will be serving as extensions of human talent.

In considering all the benefits of a computerized society, we must remember that they depend primarily upon two developments: a vastly increased capacity, complexity, and accessibility of computer systems; and a storage of not only an infinite amount of academic information, but also a great deal of highly personal information.

While only computers can take the immense task of helping us reach coordinated decisions with the extensive records they handle, there is a natural human dislike of becoming a statistic. This dislike becomes even stronger when the statistic grows into a lengthy dossier providing intimate details about one's personal life, and may become available to any number of persons for any number of reasons.

Privacy is one of our most precious rights, and in today's crowded and disorderly environment, it may be one of the hardest to maintain. However, the computer does not in itself create any invasion of privacy. Its role is no more active in this respect than the old-fashioned filing cabinet. The only new element in the threat to privacy posed by record-keeping, is the computer's fantastic efficiency. This is what people really fear, and this is the problem that must be faced. Technology must look ahead at the problems which it might accelerate, even if it does not really create them.

The computer industry cannot solve the problem alone, but there is a great deal that it can do, both technically and

ethically. Technically, safeguards can be built into a design system to limit those having access to the system. However, as much as machines do to protect the privacy of computerized records, they can never be reguarded as absolutely invincible from really determined people. More than physical safeguards must be considered. Management should not only exercise sensitive control over the trustworthiness of their personnel, but should also make sensible decisions on what kind of information will go into their files, and how long it will stay there.

As the computer industry assumes a heavy responsibility in the privacy issue, so too must the people whom it serves. The government is taking an active role in passing new laws to provide a citizen with the ability to challenge in court the release of private data about him without his consent. But the general public must become involved also in thinking about and discussing the problems generated by computerized record keeping. The weight of public opinion can do a great deal toward influencing constructive public policies and creating voluntary ethical codes and standards of practice among users of computer systems.

Computerized and centralized information systems can take us in two directions. One would lead us to a rigid, automated bureaucracy with great knowledge and power but little regard for the human consequences of its program. The other would enlist the power of computers in the service of individuals, enabling them to cope more successfully with the complexities of modern life and increasing the opportunities for successful fulfillment of their talents. Society has no choice but to use computer aids in solving the problems of our age, but it now must learn how to use these products to serve the people. If the time ever comes when the misuse of computerized record-keeping leads man to fear being curious, daring, and willing to deviate from the norm in order to experiment, it would not be a case of the machine triumphing over man, as some people fear. It would be a case of man *becoming* the machine.

How One Computer Manufacturer Looks At the Data Privacy/Security Issue

By Curtis W. Fritze
Executive Consultant
Control Data Corporation

The issue of data privacy . . . an individual's rights to control personal data . . . is a highly complex and controversial topic. It affects not only the individual, but also the agencies of government and the activities of business and other organizations which require such information to meet social and economic needs. And it also affects the design and operation of the tool most used for information processing and storage . . . the computer.

Legislation concerning data privacy is in various stages of development at state, county and even city levels. Since passage of the Federal Privacy Act of 1974 there has been an outpouring of rhetoric and written materials concerning individual rights versus information technology. Legislators, educators, civil rights groups and computer manufacturers have produced volumes of statistics, opinions and studies about the subject.

Paramount to any discussion of data privacy is "the computer," often considered the culprit because of its ability to rapidly store, retrieve, process and transmit information. Consequently, computer manufacturers as well as computer users are concerned about legislation that could drastically change administrative techniques and computer architecture. The key issue appears not whether to discontinue computer technology, but how to keep and extend its benefits while preserving the rights of citizens to privacy and confidentiality without negative impact to the manufacturers and users of computer systems.

For the computer manufacturer, data privacy automatically means providing "data security" in the computer system. This means safe-guarding confidential information . . . protecting it from unauthorized disclosure, modification or destruction, either accidental or intentional, through the use of special hardware and software. In extreme situations, this can mean additional expenditures by the manufacturer for research, development and production, as well as installation, and maintenance to meet customer specifications. On the user side, it can increase operating costs through increased equipment costs and additional computer time and generally add to the cost of doing business.

Considering all aspects — the studies, economies and social responsibilities, Control Data has developed a position on the issue; but not necessarily in support of any particular piece of legislation at least until the details of the requirements are known. A portion of this statement follows.

* * * * *

"Control Data, as a responsible corporate citizen, believes in the individual's right to privacy and supports the basic principles recommended by the HEW Report of June 1973. These principles are: (1) There should be no files of personal data, the existence of which is secret; (2) There should be a way for the individual to find out what information about him is in a file record and how it is used; (3) There should be a way for an individual to prevent information provided for one purpose from being used for another purpose without his consent; (4) There should be a way for an individual to correct or contest records about him in personal data files; (5) Any organization maintaining or using personal data files should assure the reliability of the data and safeguard the files against misuse."

* * * * *

The data privacy and security issue will undoubtedly gain momentum in the near future, just as computer systems will be a continued requirement of complex societies. The issue has a mixture of technical, social, political and legal entities. Consequently, we need sound prudent public policies, including legislation, ethical codes and standards of business practice.

These principles require careful implementation to avoid undue economic burden and impact on business. Unless this can be achieved, we may "cure the disease, but lose the patient." Continued dialogue and cooperation between government and business is absolutely necessary.

As stated in the National Academy of Sciences study: "Man cannot escape his social or moral responsibilities by murmuring feebly that 'the machine made me do it'."

Survey of Public Attitudes Toward Computers in Society

by David H. Ahl

SUMMARY

Computers are not only invading our lives along a multitude of directions — supermarkets, credit data, medical records, hobbies, etc. — but our society is becoming so dependent upon computers that it can truly be said that we live in the computer age. The computer will have at least as profound an effect on humankind as did the printing press some 500 years ago. In the Gutenberg Museum, a map plots the spread of printing out from Mainz to the rest of the world over scores of years. The computer invasion has taken place at an infinitely greater speed.

Now, some 30 years after its invention, what do people think of the computer? Monster or savior? Slave or dictator? Do people understand this awesome force?

This survey indicates that most people are remarkably optimistic about the benefits the computer can bring to society in a number of areas — for example, education, law enforcement, and health care. People feel they are unable to escape the influence of the computer and that it has some undesirable effects; however, they do not feel particularly threatened by it. Young people tend to be less optimistic and feel more threatened by the computer than do adults. A surprising two-thirds of the population have a fair understanding of both the role and function of the computer although there are a few popular misconceptions.

Compared to the 1971 AFIPS/*Time* survey, people have become more optimistic about the use of computers in most areas with the notable exception of credit data banks. Also, this *Creative Computing* survey identified the computer influence on elections as a real danger area — to our knowledge this has not been previously surveyed.

METHODOLOGY

During the 6-month period, February through July 1975, *Creative Computing* Magazine conducted a survey on people's attitudes toward computers and their role in society. Some 843 people responded in two highly computerized nations, the United States and Germany. About one-third of the respondents were educated or experienced in computer usage; two-thirds were not. Thirty-six percent of the respondents were classified as young people (20 and under) and students; the remainder were a relatively balanced cross-section of adults.

The 17 questions in the survey fell in four major categories (although they appeared in random order on the survey instrument). The categories:

1. Computer Impact on the Quality of Life (4Q)
2. Computer Threat to Society (4Q)
3. Understanding of the Role of Computers (5Q)
4. Understanding of the Computer Itself (4Q)

In some cases where the questions were similarly worded, the responses to this questionnaire are compared to those from a 1971 survey jointly sponsored by AFIPS (American Federation of Information Processing Societies) and *Time* Magazine.

COMPUTER IMPACT ON THE QUALITY OF LIFE

On the whole, respondents felt that the computer will improve the quality of life in four areas: education, law enforcement, health care, and prevention of fraud. Young people and students saw somewhat less improvement from the use of computers than did adults.

Computers will improve education. About 85% of all the respondents strongly or mostly agreed with that statement and only 5% disagreed. This was the highest positive (or negative) response to any single question and also the question which had the greatest agreement between adult and youth.

Computers will improve law enforcement. 82% of the adults agreed with this and only 3% disagreed. The younger respondents were somewhat more cynical; 70% agreed and 10% disagreed.

Computers will improve health care. On this issue, the young respondents had considerably more doubts than adults; about 79% of the adults agreed but only 54% of the youth. More than twice as many youth disagreed with the statement as adults — 12% vs. 5%.

Ranking lower on desirable uses of the computer is its use for *storing and checking credit rating data*; 64% of both adult and youthful respondents saw this as a worthwhile application. However, 13% of the adults thought this was a bad application for the computer, perhaps reflecting previous hassles that they or friends had with computerized credit rating data. Most young people probably haven't been exposed to this malady; only 8% of them objected to this application. While substantial, the 64% of the people in favor of this application represents a substantial decline from the 75% recorded just four years ago in the AFIPS/*Time* survey.

THE COMPUTER THREAT TO SOCIETY

Respondents were mixed in their feelings about the threatening nature of computers. Most felt they were unable to escape the influence of the computer. Nearly half saw computer predictions influencing the outcome of elections. More than one-third felt that computers dehumanize society to some extent. About one-quarter saw the computer taking more jobs than it creates. And about one-fifth saw the computer having an isolating effect on programmers, operators, etc.

A person cannot escape the influence of computers. 92% of the adults agreed with that statement, most "strongly" agreeing; only 4% disagreed. These percentages are virtually the same as those recorded in the 1971 AFIPS/*Time* survey. Reflecting a more optimistic, perhaps somewhat naive view that one can drop out and avoid anything one doesn't approve of, only 67% of the young people felt they could not escape the influence of computers and 18% strongly disagreed with the notion that computers couldn't be avoided.

Computer polls and predictions influence the outcome of elections. About 46% of the respondents agreed with this statement and 27% disagreed. In a democratic society, this is truly of grave importance. If almost half the people, adult and youth alike, feel their voting behavior is in some way influenced by computer polls and predictions (join the bandwagon, we've lost so why bother voting, etc.) then we have a real problem.

Computers dehumanize society by treating everyone as a number. Reflecting a rather positive shift in attitude, only 37% of the adult respondents agreed with this statement and 50% disagreed compared to the percentages of 54% agreement and 40% disagreement just four years ago in the AFIPS/*Time* survey. The younger respondents in the current *Creative Computing* survey were more pessimistic; 40% agreed that computers dehumanize and only 31% disagreed. (Youth were not included in the 1971 survey.)

Computers isolate people by preventing normal social interactions among users. Computer bums and computer freaks are common around any school with a computer. Million dollar corporate computers have to be fed data around the clock to justify their investment and there is a growing army of midnight shift programmers and operators. Among the uninitiated, FORTRAN or COBOL are more foreign than French or German. Are computers really isolating segments of society? Maybe, but apparently it's not very noticeable since only 20% of the respondents agreed with the statement above. More revealing, however, is the fact that 63% of adults disagreed with the statement and only 43% of young people disagreed. Perhaps computer freaks, who tend to be among the younger cadre, *are* becoming more evident.

UNDERSTANDING THE ROLE OF COMPUTERS

This issue was examined from two directions: what types of jobs are suitable for a computer and what will be its effect on human employment (or unemployment)? For the most part, adults saw the computer as suitable for dull, repetitive tasks like a hammer or lathe while young people saw computers in much broader roles. Furthermore, adults saw computers replacing low skill jobs and creating just as many jobs as they eliminate; young people were not as optimistic.

Computers are best suited for doing repetitive, monotonous tasks. Eighty percent of the adults agreed with this statement and 10% disagreed. Among young people, 57% agreed, 22% disagreed. In other words, young people see the computer doing a wide variety of things beyond simply data processing, numerical machine tool control, and telephone switching. But perhaps in some of these more sophisticated applications in which the computer takes over some of the human decision-making function, youthful respondents are more fearful of computers and less optimistic than adults.

Computers are a tool just like a hammer or lathe. Again, adults are in considerably greater agreement with this statement than are younger respondents.

Computers slow down and complicate simple business operations. Interestingly enough, most people seem to believe that computers are used reasonably well in business because 68% disagree with this statement and only 17% agree.

Computers will replace low skill jobs and create jobs needing specialized training. Somewhat more adults agreed with this statement (71%) than did youth (62%). About 15% of both adults and youth disagreed. This implies that a substantial fear exists that computers will take a tremendous number of jobs and there will have to be a massive effort by society (retraining, welfare, or ?) to absorb the human beings put out of work by the computer monster. This leads to the next question.

Computers will replace as many jobs as they eliminate. Again, somewhat more adults agreed (70%) than did youth (61%) and fewer adults disagreed (13%) than youth (23%). So we see that a large number of people believe the computer will replace low skill jobs, but furthermore, we see some question about the creation of new jobs by the computer to replace the ones eliminated and, as before, there is even more doubt expressed by youthful respondents.

UNDERSTANDING OF COMPUTERS

After looking at the various roles of the computer, one must ask, do people understand the computer per se by itself? And the answer is that a surprising number do. And quite a few don't. Indeed between one-quarter and one-third of the population believe the computer is beyond the understanding of the typical person. Also, many people have the wrong notion about who causes computer mistakes — machines or people.

Computers are beyond the understanding of the typical person. Are they? Well 25% of the adults and 31% of the youth think so. But 62% of the adults and 49% of the youth think they are within comprehension. Perhaps more revealing — among schools with an instructional computer program, over 80% of the students believe that computers are within their understanding.

Computers make mistakes at least 10% of the time. This statement must be coupled with the next one: *Programmers and operators make mistakes, but computers are, for the most part, error free.* FACT: Statement 1 is absolutely false, statement 2 is true. How did respondents do with these questions? Most answered "correctly" — about 68%, fewer youth than adults, but a fair number of people were downright wrong (13%). The rest of the people didn't know (19%). These percentages are similar to those scored on nationwide tests of scientific facts — about 2/3 of the people know the facts but the other third are wrong or just don't know. A happy situation? Not very.

It is possible to design computer systems which protect the privacy of data. Not even the computer designer knows for sure, so what can we expect from the general public? Well, 61% of the adults think you can design a secure system and 26% think you can't; only 49% of the youth think you can and 16% think you can't. What does all this say? Probably nothing except that some people are optimists and some are pessimists, and at least on the data privacy issue, more adults are optimistic than young people.

STATISTICAL RESULTS OF SURVEY OF PUBLIC ATTITUDES TOWARDS COMPUTERS IN SOCIETY

	ADULT (N=300)		YOUTH (N=543)	
	Strongly or Mostly Agree	*Strongly or Mostly Disagree*	*Strongly or Mostly Agree*	*Strongly or Mostly Disagree*
Computer Impact on the Quality of Life				
• Computers will improve education.	86.6%	5.9%	84.2%	4.5%
• Computers will improve law enforcement.	81.9	3.3	70.0	10.1
• Computers will improve health care.	78.6	5.3	54.1	11.9
• Credit rating data banks are a worthwhile use of computers.	64.2	13.4	64.0	7.6
Computer Threat to Society				
• A person today cannot escape the influence of computers.	91.6	4.0	66.6	17.7
• Computer polls and predictions influence the outcome of elections.	48.1	27.5	44.2	26.9
• Computers dehumanize society by treating everyone as a number.	37.4	50.3	39.9	30.6
• Computers isolate people by preventing normal social interactions among users.	18.7	62.5	20.9	42.5
Understanding the Role of Computers				
• Computers are best suited for doing repetitive, monotonous tasks.	80.0	10.3	57.0	21.6
• Computers are a tool just like a hammer or lathe.	72.6	14.7	61.3	23.4
• Computers slow down and complicate simple business operations.	17.6	66.4	17.4	68.8
• Computers will replace low-skill jobs and create jobs needing specialized training.	71.0	15.0	61.8	14.4
• Computers will create as many jobs as they eliminate.	62.5	16.4	40.0	29.1
Understanding of Computers				
• Computers are beyond the understanding of the typical person.	25.2	61.6	30.6	49.2
• Computers make mistakes at least 10% of the time.	9.6	76.7	10.3	60.0
• Programmers and operators make mistakes, but computers are, for the most part, error free.	67.0	19.3	72.3	13.3
• It is possible to design computer systems which protect the privacy of data.	60.2	26.4	48.6	15.9

NBS Privacy Conference

From April 2 to April 4, 1975, the National Bureau of Standards and the MITRE Corporation held a symposium and workshop in McLean, Virginia in order to allow computer users from business and government to exchange their views on the impact of privacy legislation. Excerpts from some of their talks follow:

Representative Edward I. Koch (D–NY):

. . . Notwithstanding the deficiencies of the Privacy Act, I feel it represents a monumental breakthrough in the field of personal privacy safeguards.

Millions of files that are locked away from the public will become available in September 1975, so that one can see one's own file, see whether the material in it is relevant, see whether it is accurate, see whether it is current, and, if it is not, provide the mechanism whereby corrections can be made. Also significant is that the Privacy Act contains a provision forbidding all agencies, including law enforcement agencies, from maintaining a record of the political and religious beliefs or activities of any individual unless expressly authorized to do so by statute or by the individual himself.

There are changes I would like to see in the Privacy Act. First of all, the law is deficient in the area covering law enforcement agencies . . . . I feel that criminal justice systems should be included in the Privacy Act until the Justice Department can come forward with a proposal that the Congress can agree upon. The second change I would like to see would be a removal of the near blanket exemption given to the CIA and a tightening up of the exemptions pertaining to the FBI. The exemptions should be limited only to those files having to do with national defense and foreign policy, those containing information held pursuant to an active criminal investigation, and those maintained for statistical purposes and not identifiable to an individual.

I feel that provisions allowing an agency to withhold from an individual the source of confidential information in his file should be deleted . . . . And, most importantly, I would like to see the establishment of a Federal Privacy Board which would monitor agencies' compliance with the Act and work in somewhat of an ombudsman's capacity and hold hearings for those individuals who want to air their grievances.

We need a broad federal policy to set the basic standard for privacy protection both in the public and in the private sector. But we have to be able to move beyond the broad approach to appreciate the specific needs of different sectors of the government and private organizations. When separate pieces of legislation come before the Congress for consideration, if privacy protections can be included, I certainly will support adding such provisions.

Joseph L. Gibson, senior attorney for Marcor, Inc.:

Recent reports have given the appearance that the privacy issue is a national crisis which suddenly sprang forth from the anti-Vietnam war movement and Watergate. That appearance is not accurate. The issue of privacy has a substantial history: current trends began a decade ago. The issue will be satisfactorily resolved, not by restating a few general principles, but only by devising a number of specific solutions for specific problems.

Charles Work, deputy administrator, Law Enforcement Assistance Administration:

I am confident that law enforcement can meet the challenges posed by the regulation and proposed legislation. I am also confident that in the long run, law enforcement and law enforcement agencies will be much better for it. Many of the enumerated requirements are not difficult to meet; a much more difficult requirement is that the records must be accurate, complete and up to date. We need systems with bank-type auditing capacity so that the defendant can be traced through the system. This is a very significant challenge, ... because if management cannot get the data into the systems, it will not meet the requirements of privacy and it will not be the system's fault. It could also be costly, because management systems cannot be significantly improved without a significant increase in manpower. But in the long run, the privacy mandate will dramatically improve the systems and must improve the overall management of concerned agencies.

Naomi Seligman, McCaffery, Seligman & von Simpson, management consultants:

One cannot speak of the impact of privacy legislation on the economy as a whole, but instead must separate its impact into three distinct sectors of data base users: government agencies, third party services — such as credit bureaus — and the broader run of U. S. business. The real costs of privacy violations to the individual clearly relate to a large number of social issues.

Almost all analyses of the issue begin with the assumption that data is always used to an individual's disadvantage; yet, many data bases are used to provide privileges which would be impossible without such data. Specific cost is very much associated with the nature of specific data disclosed about the individual. I strongly believe that the principles of the HEW Report can be achieved by general business without any of the problems or onerous costs.

Ruth M. Davis, NBS conference chairperson:

The first law that we talk about in the area of privacy came into being in 1974, 194 to 198 years after manual systems of handling information had been officially used by the U. S. and by organizations operating in the U. S. The new laws come at a time of dramatic change in electronic, optical, and communications technology. This is the setting in which we are trying to formulate actions.

One requirement (for action) is the "retrofitting of all existing information systems to make sure that they meet new legislative requirements. Second, there is a need to determine, validate and insure compliance with the laws of existing and new systems. Third, there is a need for developing and introducing the technologies that will allow the required changes in information handling so that the systems are operationally effective, legal, and economically possible. Last, we must dust off and refine good information management practices.

The privacy mandate, along with its accompanying requirements should not be taken lightly. At the same time it should be reviewed in terms of the many kinds of effects it can have.

The Fine Line between Personal Freedom and Public Security

How Much Privacy Should You Have?

by Alan Westin

Have you ever wondered what information about you is in the files of large federal service agencies such as Social Security, the Veteran's Administration, or the Agriculture Department?

If you once served in the armed forces or worked for the federal government, have you wondered what ratings or evaluations were made about you, and to whom these have been released?

If you have applied for any license administered by the federal government – to the Federal Aviation Agency as a pilot or to the Coast Guard as a boat owner – have you wondered what other government agencies or private organizations get access to the personal information you supplied?

If you were ever arrested – including arrests for civil rights protests, political demonstrations, or marijuana offenses – have you felt worried about the FBI's dissemination of that information to local and state licensing bodies, bonding agencies, banks, or local police departments?

If you work for a business covered by federal equal employment opportunity regulations, do you know how your minority designation is listed, and what is done with it?

Have your children been part of a federally funded social research project in school? If so, were you ever told what future uses would be made of the personal and family data that was collected?

Do you find yourself wondering sometimes what federal records may have been opened about you that you don't even know about – by the Internal Revenue Service, Army Intelligence, the Passport Office or even the White House?

Finally, have you ever asked to see what was in a federal agency's file about you, and did agency officials make it difficult or even impossible for you to do so?

If such concerns about the federal government's collection and use of personal information have occurred to you over the past few Watergate-shrouded years, or if

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Dr. Alan Westin is a professor at Columbia University, New York. As an expert witness on privacy he has written extensively on the subject and testified before several Senate committees.

How Much Privacy Should You Have?

you have had similar thoughts about the data-collection activities of local and state governments, business corporations, schools and universities, and other organizational record-keepers in American society, you are far from alone. In 1970, a national Harris poll found that one out of three Americans was personally worried about invasions of his privacy. While eavesdropping on telephone conversations was mentioned, the most widely cited complaints involved personal data collection by organizations. These included "computers that collect too much information," credit inquiries by business, and the way the federal government collects taxes and takes the census.

Normally, what disturbs every third American gets some fairly serious attention from the nation's lawmakers. But the trouble with protection of privacy, from the surfacing of this issue in the early 1960s until 1974, was that American legislators treated it much like the weather—everyone talked about the problem but no one was willing or able to *do* anything about it.

Citizen's Rights—The Federal Privacy Act of 1974

Then came Watergate. Between 1972 and 1974, Americans learned to their shock and dismay that White House agents had ordered the tapping of the Democratic Party's telephones, the burglary of a psychiatrist's office to get confidential medical files on a Vietnam war critic, and the assembling of income-tax data and sex-life information on members of the press and political critics of the Nixon Administration.

By 1974, national polls reported that one out of *two* Americans now felt that his personal privacy was threatened.

In this Watergate-dominated atmosphere, Congress finally did act. In a move that has so far received far too little attention in the popular media, Congress passed the Federal Privacy Act of 1974, one of the potentially most important citizen's rights laws in the computer age. Since the new law governs the collection of personal data by virtually all federal agencies and gives individuals important new powers to protect themselves against abusive practices, it is crucial for the protection of privacy that the public learn just what the Privacy Act does for them.

By the time that Congress decided that it *had* to pass some major privacy legislation in 1974, at least covering the federal government's own files, three key issues of data privacy had come into focus:

- What personal information ought to be collected at all by a given federal agency or department, to carry out its lawful functions?
- If personal information is properly collected, how can we be sure it is kept confidential within the collecting agency, for the purpose originally intended, and not shared improperly with other government officials or private organizations?
- Shouldn't individuals almost always have a legal right to inspect that record, if they wish, to check its accuracy, completeness, and lawful use?

As it faced these difficult questions of judgment, Congress was aware that far more was at stake than assuring the constitutional rights of political radicals or Mafia leaders. Hearings chaired by Senator Sam Ervin, Jr., and other Congressional leaders had documented that "derogatory information files" were being amassed on hundreds of thousands of Americans by federal investigative agencies. Even more fundamentally, every American's access to the benefits and opportunities controlled by organizational record-keepers could be imperiled by inaccurate, incomplete, or improper data-collection practices, especially by the federal government.

WHAT THE GOVERNMENT HAS ON YOU

Here are two public agencies set up to tell what the government has in its files regarding you.

Domestic Council Committee on the Rights of Privacy
White House
Washington, DC 20504
(202) 395-3254

National Commission on Wire Tapping
1875 Connecticut Ave. N.W.
Suite 708
Washington, DC 20009
(202) 382-6782

By 1974, Congress had also learned through studies by the National Academy of Sciences and a Citizen's Panel report for the Department of Health, Education, and Welfare that the basic issues were not caused by *computers*, and no "pull-the-plug" decision could resolve the problem. Computerized files and databanks were increasingly the *setting* in which the social policy issues had to be faced, and computers tend to *magnify* the injuries that can be done. But Congress realized that the basic issues concerned how Americans were to be judged for various rewards and opportunities in our society, and through what kinds of fair procedures.

So the Federal Privacy Act of 1974 took a major step forward, by requiring federal agencies to follow a code of fair information practices in handling citizen information, whether in computers or on cards. Stripped of technical language, some of the Act's main sections provide that:

- Individuals must be told, whenever they are asked to give personal information, what legal authority the agency has to ask for this, whether supplying it is voluntary or required, and how it will be used.
- Individuals can inspect their own records if they wish, obtain a copy of them, and have their accuracy verified and officially corrected if found to be inaccurate.
- Individuals can find out who else besides the agency that collected the information has had access to their records.

Guidelines for Federal Agencies

As its basic framework, the Act sets out standards and procedures for federal agencies to follow as "fair information practices." Federal agencies must collect only data "relevant and necessary" to their lawful function. They *cannot* collect information about how we exercise our First Amendment rights of speech, press, association and religion, unless such collection is expressly authorized by law. Agencies must take reasonable steps to see that our records are "accurate, relevant, timely and complete."

At least once a year, each federal agency must publish a public notice about each system of personal records it maintains. This must state the system's name, location, categories of persons covered, users of the system, policies as to storage and retrieval, controls over access, and procedures for individuals to inspect and challenge their records if they wish.

Most important of all, the Federal Privacy Act makes it a crime for federal officials knowingly to violate the Act's requirements. It also gives individuals the right to sue in federal court to enforce access, correction or compliance with the Act, with damages and even lawyers' fees provided in cases of willful violations.

The Act contains a few controversial exceptions, for investigative activities of law enforcement agencies, the CIA, and certain kinds of personnel-checking inquiries. But the Act's coverage is still remarkably wide, probably reaching more than 95 percent of the record-keeping activities of the federal government.

In order to give federal agencies a chance to get their enormous file collections into good order and to install new procedures, the Privacy Act does not take effect until September of 1975. That also gives us as citizens a chance to learn what the Act does and how *we* can use it.

Memoirs of an Ex-Social Security Number Giver

by Dr. Patricia Campbell

Once when I was young and naive, I was full of pride at having a real number of my own, one that was verified by a piece of paper issued by the United States Government. I had my own unique social security number. It didn't bother me that some of my greedy friends had several social security numbers. It didn't even bother me when two of my multi-card friends found they shared the same number. After all the government was in charge of social security numbers, and they wouldn't louse up anything as important as this.

So my social security number and I continued our relationship. Its red and white card said, "Not For Identification Purposes," but what did that mean? 172-38-7613 and I were one.

As the card and I grew older and we both lost some of our shine, I memorized my number and put the card in a safe place where it could be retrieved in case of emergency or memory lapse. But there really wasn't much chance that I would forget those nine digits, because everyone kept asking me what they were. At first I proudly reeled off the number and waited for people to respond, "Oh, you memorized it." But soon I began to wonder if the Social Security Administration really needed to know about things like my telephone calls and my electric light bill in order to figure out how much money I was entitled to upon retirement.

"I want to apply for an unlisted zip code."

So when the gas company asked for my social security number, I asked them if they were going to contribute to my social security checks. They said no, I said why do you need the number, and the clerk looked around for help. No one could tell me why they wanted that number, or what they were going to do with it, other than "put it in a computer."

A computer, me, and my unique (or almost unique) number; all of a sudden it started to make sense — the gas company, the telephone company, voter registration, the office of motor vehicles, the credit offices, and even the rent-a-car people would all have information about me under the same number. And without my permission or even knowledge, all this information, correct or not (I started remembering my two friends with the same number) could be put together. With visions of George Orwell and 1984 on one side and the Bill of Rights on the other, a private revolution was born.

The credo of this revolution would be simple and hopefully easy to live with. "NO LONGER WOULD ANYONE WHO DIDN'T HAVE A LEGAL RIGHT TO MY SOCIAL SECURITY NUMBER GET IT."

My credo was first tested when it came time to change my driver's license. As the burly state trooper asked for my social security number my resolve weakened and I asked, "What would you do if I wouldn't give you my social security number?" "Give you another number," was his response, and another number I got.

It hasn't always been that easy; in fact, a predisposition toward threatening people with your lawyer is very helpful in this revolution. Through the use of patience, threats and repetition ("You can't deny me my right to vote because I won't give you my social security number" repeated 50 times at unequal intervals works wonders), I have had numerous successes and only one failure (Federal law demands your social security number for checking accounts).

So onward I go, forever confident that when the CIA and FBI ever get around to my file, it will be a little harder for them to fill it.

(By the way, the social security number I used in the story isn't mine; I don't give my social security number, remember.)

Dr. Campbell is an Assistant Professor in Educational Foundations at Georgia State University, teaching graduate educational research and methods of evaluation. She is active in research and lecturing on sex-role stereotyping, as well as in rape prevention. She is also a member of the Board of Directors of the American Civil Liberties Union of Georgia.

Her fight against the use of social security numbers for any and everything has been a long-standing battle against invasion of personal privacy and the constant collection of unnecessary information by many private and public agencies.

PROSECUTOR MANAGEMENT INFORMATION SYSTEM

by Susan Hastings

PROMIS (Prosecutor's Management Information System) is a computer-based system for public prosecution agencies. Developed by the Institute for Law and Social Research under a grant from the U.S. Department of Justice Law Enforcement Assistance Administration (LEAA), PROMIS has been in operation in Washington, D.C. since January 1971.

While there can be no substitute for skilled, experienced prosecutors, PROMIS permits a prosecutor's office to accumulate a wealth of information on each of its burgeoning cases and maximize what manpower is available by assuring that office operations are conducted in the context of modern managerial and administrative methods. As a prosecutor finds he can devote more time to priority areas, he can more efficiently exert positive and productive control over his workload.

One of the most important functions of PROMIS is its ability to screen the massive influx of information with which prosecutor's offices are faced. Facts are the raw material for the prosecutor. The decisions he makes about a case are based on the soundness of the facts that are available. PROMIS's computerized data base enables prosecutors to acquire and process facts in a consistently comprehensive and uniform matter.

PROMIS gives prosecutors a method by which they can evaluate and rate cases in terms of the gravity of the crime and the accused criminal's background. Cases can be rated evenly through computer-generated numerical scores, thus giving the chief prosecutor the managerial leverage he needs to apportion his office's time and manpower according to the relative importance of pending cases. He can then assign the priority for more intensive pre-trial preparation to the cases which involve violent crime and habitual criminals.

Because of the massive caseload faced by prosecutor's offices, many serious offenders often avoid proper punishment because the responsibility for their cases has been fragmented and/or delayed to the point where the court-wise repeat defendant is able to maneuver his case through the cracks in the system. PROMIS however, can help to alleviate this problem by generating, five days ahead of time, a calendar that ranks in descending order of importance the cases a court will try on a particular day. The prosecutor's office can than allocate its manpower to prepare itself sufficiently for the most serious cases.

The judicial process cannot function without the active cooperation of citizen jurors and witnesses, but witnesses are often disillusioned by court scheduling conflicts. PROMIS enables a Witness Notification Unit to locate and subpoena witnesses in order to schedule their appearance in court. It also tries to provide a coordination of scheduling that is convenient to everyone in order to avoid the delays that often prove inconvenient, confusing and unnecessarily frustrating.

The implementation of PROMIS in Washington, D.C. has heightened awareness about the utility of legal paraprofessionals. These non-lawyer college graduates perform time-consuming duties that do not require the specialized training of an attorney. PROMIS made it obvious that full documentation of reasons for prosecutorial actions was not being made, and the visibility of this problem led to the creation of the paralegal positions. As the procedures of the prosecutor's office became better structured and more systematized through PROMIS, there is indication that more and more tasks will fall within the capabilities of paralegals, and skilled attorneys will be able to direct their abilities more fully toward case preparation and prosecution. Additionally, errors and omissions which might occur when an overtaxed attorney is charged with the duties of citizen interviews and case documentation, might be lessened as paraprofessionals take over this ministerial task.

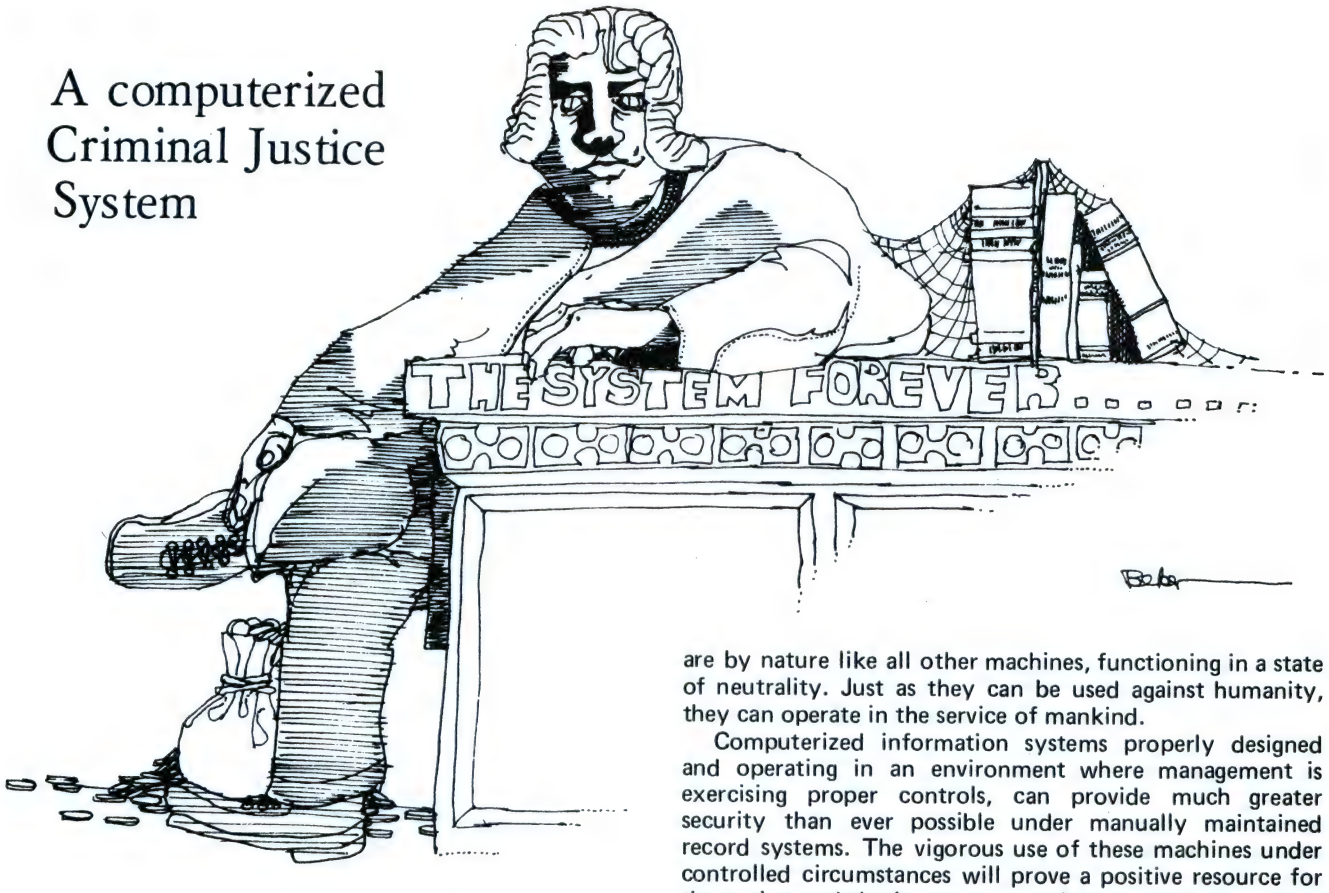
Just as PROMIS has demonstrated the need for paralegals, it can also be used to pinpoint the areas in which they should be trained. PROMIS-produced data which can gauge the effectiveness of a given training program can also indicate areas in which prosecutors themselves need further training.

The reach of the prosecutor extends from one end of the criminal justice system to the other, starting with the police and ending with corrections. With the advent of PROMIS, prosecutors possess a potent tool that will help them take full advantage of their position within the system. A 1970 statement by Chief Justice Warren E. Burger expresses the need that people in this country feel for such an aid:

"In the supermarket age, we are trying to operate the courts with cracker-barrel corner grocer methods and equipment — vintage 1900 . . . the judicial processes for resolving cases and controversies have remained essentially static for 200 years. That is not necessarily bad, but when courts are not able to keep up with their work it suggests the need for a hard new look at our procedures." A method like PROMIS that enables prosecutor's offices to collect data on a routine and systematic basis, may well prove the answer to increasing the effectiveness of our criminal court system.

[For more information, write C. Madison Brewer, Institute for Law and Social Research, 1125 15th St. NW, Suite 625, Washington, D.C. 20005.]

A computerized Criminal Justice System



by Melvin F. Boekelman
Police Dept., Kansas City, Mo.

We live today, in a time in which 90% of the scientists who have ever lived, are now living; at a time in which knowledge, that prior to this century doubled every 50 years, now doubles every five years; a time in which the dramatic technological advances of the electronic computer have given us the capability to calculate information 500 times faster than we could prior to World War II. Leading economists have stated that automation is by now so deeply implanted in our economy that we are beyond the point of no return to non-automated systems. As a result of its powerful calculating capabilities, the electronic computer is today making us aware of many facts and theories that have been hidden from us since the beginning of time. It is the computer, more than any other facet of modern day technology, that is providing the capability to solve the complex problems of our environment.

While overwhelming evidence convincingly supports automation, we have been confronted with a great uproar of anti-computerism from segments of our society. There is a fear that reducing the human being to a number means the loss of identity and that this is representative of all that is demoralizing and degrading to our society. It has been suggested that people hate computers because they are the first machine in history to really move in on our intellectual and emotional lives. The machine is suspected of recording everything in our lives from the womb to the tomb, and is thought to replace the activities of numerous individuals.

Records that can tell a great deal about one's activities, habits, associations and personality characteristics can be, and are stored in the memory bank of a computer. If the data were made available under unauthorized or unethical circumstances, the result could be damaging to the individual, and eventually, to society. However, computers are by nature like all other machines, functioning in a state of neutrality. Just as they can be used against humanity, they can operate in the service of mankind.

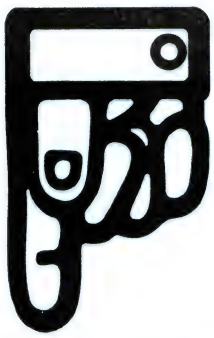
Computerized information systems properly designed and operating in an environment where management is exercising proper controls, can provide much greater security than ever possible under manually maintained record systems. The vigorous use of these machines under controlled circumstances will prove a positive resource for the nation and the improvement of the quality of our lives.

The criminal justice system in the USA has been slow in casting aside old, outmoded, and antiquated ways of operating. Today the picture is changing rapidly as a result of automation and so are the social implications that result from the new technologies.

The Kansas City Regional Criminal Justice System uses the computer to protect the public, assist the victim, apprehend the criminal, and process the case with all the efficiency and security that can be commanded from present day technology. Records show that the Criminal Justice Data Bank Alert II is being accessed for entry of data or for inquiry of information an average of 35 times every minute of a 24 hour day. The Kansas City Regional computer is exchanging information automatically with the FBI's National Criminal Information Center 3,000 times each day. It's data base is extensive, and records on-line 26 major categories of information which total over one million on-line records. In the system, 1,000 subjects who are known to be armed, dangerous, or likely to resist arrest, are tagged.

An individual's right to privacy, whether he is a criminal or not, however, must be protected, and this is conscientiously considered in the use of the system. Mobile terminals, instead of the traditional radio systems greatly enhance the privacy and security of criminal justice data. Manual and software controls range from administering extensive personality tests to computer applicants to installing bullet proof security walls in the computer complex. Procedural Instruction 73-3 prohibits the processing of any report without the approval of the Criminal Justice Agency, and many strict policy statements about who can use the information and what he can do with it are other steps taken by the department to protect the security and confidentiality of the system.

*Condensed from an article in *Computer & Society,* Vol. 6, No. 1.



Embezzler's Guide to the Computer

by Brandt Allen
University of Virginia

Computerized embezzlement may be the best game in town. It doesn't really matter whether the target organization is profit-oriented, governmental, or a not-for-profit group. It does help the potential embezzler, however, if he is in a position of responsibility and is a "trusted" employee. He needs a basic knowledge of accounting, record-keeping, and financial statements, but he doesn't have to be a computer expert. Computer technology tends to confound auditors and managers themselves so much that they are rarely in a position to detect or prevent the embezzlement. Embezzlement is far less risky than ordinary theft, and far more rewarding. An added attraction for the embezzler is the fact that even if he should get caught, he probably wouldn't even have to go to jail. In a large percentage of cases, embezzlers aren't prosecuted because a concept dating back to English common law makes embezzlement a crime against an entity and not an individual.

Embezzlers shouldn't count on being caught though. The prognosis for successful computer-based crime is good. Virtually all of the traditional peculation opportunities of the past may be run through the computer, and a host of exciting new schemes is possible as well. The best embezzlement schemes have to be well executed to work, but the ideas are simple.

For any employee who really wants to practice this lucrative game, the best place to start is probably with a disbursements fraud. Historically, this kind of crime has accounted for more embezzlement losses than all others. The approach is really quite simple: an organization is forced into paying for goods and services that it did not receive, and payment for them is made to a bogus company. Anyone who wants to successfully accomplish this kind of fraud can do so by carefully studying his company's procedures for account-keeping, purchasing, and receiving. Vouchers and invoices have to be falsified, but for an employee in accounting or data processing, sometimes it is as simple as punching a few cards and entering them as if they were legitimate into a batch of transactions. Second-generation computer systems make this job more difficult because computer files of open purchase orders and merchandise receipts would not correspond to the various duplicate files maintained elsewhere, but this kind of danger can be minimized by stealing from inventory accounts with high activity and high value from which a certain amount of loss is "expected" by companies. If any one account isn't "hit" too hard, a company will probably tolerate the loss before it triggers a thorough investigation. Managerial style is often the key as to who gets robbed and who doesn't. Potential embezzlers should stay away from "detail men" and pick on the accounts managed by people who do not or cannot pore over financial statements, analyze the operating variances, and scrutinize the purchases, prices, terms, and inventory levels. Since all embezzlement efforts are conducted through accounting systems with a number of tests and controls, a little homework in studying the company's computer operations and controls can allay any of the dangers they might hold.

Inventories themselves can be a source of revenue to the embezzler, and it is often easier to convert goods to cash than it is fraudulent checks. Computerized inventories lend themselves to penetration for two basic reasons: they account for a large amount of material, and the controls on access systems are usually lax. One outstanding example of the possibilities of inventory theft via computer is the railroad company which lost 200 boxcars when an employee altered input data in the company's rolling stock to reflect that the cars were either scrapped or wrecked, when they were actually shipped to another company's yards.

Still another fruitful area for the embezzler is the manipulation of shipments, sales, and billing procedures. A company can be confused into shipping a product to a customer without sending a bill, or shipping something and billing it at the wrong price. Improper credits or adjustments on returned or damaged merchandise can be granted. Sales commissions, allowances, and discounts on merchandise can be manipulated. The computer makes it easy to alter shipping documents because in many computerized order-entry systems the sales record is maintained on file and is normally not updated until the order is shipped. Sales order records can be altered after the shipment has been made, but before the billing processes are started.

Payroll processing functions in large organizations offer a ready source of funds to embezzlers who understand how they operate; and employees in data processing, payroll, and programming are in ideal positions to make their schemes work. They can alter input data to pad the payroll with extra hours for themselves and others, but this is often a risky business. Simpler, and more lucrative are the schemes of creating fictitious personnel or increasing by small amounts the money withheld from employees' checks for income taxes and other purposes. Funds can often be embezzled from money destined for the payment of pensions, employment benefits, and annuities by keeping a dead beneficiary on file, and having his address changed to the embezzler's own.

Any of the schemes described could be perpetrated without the aid of the computer, but the computer actually makes them a lot easier to enforce successfully. The computer accepts all input as the truth. Access to computer records is often easier than to manual records, and an embezzler's visibility when committing the crime is a lot less. And, if a foul-up should happen to occur, people are always ready to make the computer the scape-goat.

*This article is condensed from one of the same title which appeared in *Harvard Business Review,* Jul-Aug 1975.

Credit Card Crooks

In Brooklyn, New York, there is a certain stretch of one street that is now known as Mugger's Alley. On this particular street there stands a bank computer that serves as a 24-hour-a-day cash dispenser. The customer sticks his credit card into the machine and the machine forks over a folderful of money. Then a mugger sticks his gun into the customer's back and the customer forks over the money to the mugger.

This is one example of credit card thievery. But it is by no means the only type that can occur, nor is it the most serious kind of credit card crime. Instead, picture this scene from the very near future: A new breed of electronic mugger eliminates the middleman (the credit card customer) and mugs the computer itself — electronically bypassing the various checkpoints and making the cash machine regurgitate money until it is empty. It would be the proverbial perfect crime: thousands would be stolen and there would be no witnesses, no evidence and no documentation. It may have happened already. The technology for cleaning out a money machine is known, and for an electrical engineer, it is neither difficult nor costly.

If this sophisticated kind of bank robbery has actually ever occurred either no one knows about it or no one is talking about it. Banks and computer manufacturers are working feverishly to prevent such grand larceny from taking place, but they have yet to find a way to enforce security economically.

The only solution they have come up with is the magnetic stripe, a black line on the back of many credit and charge cards. The composition of that stripe is similar to the sensitive surface of sound-recording tape. Instead of recording sounds, however, the "mag stripe" records various bits of information about the card and its holder, encoded for reading by a computer terminal for transmission to a central computer. In much the same way that a playback head on a tape recorder picks up and transmits the sounds recorded on the tape, a "reader" picks up and transmits the data encoded on a mag stripe to a centrally located computer which runs a check on the card and sends back either an all clear or a warning signal. The entire process takes only a few seconds to complete. Security provided by a mag stripe is not only quick and convenient, it also thwarts the major techniques of today's credit card thieves — stolen and altered cards.

Magnetic stripes may sound like the answer to a credit card security officer's dreams, but, unfortunately, the equipment needed to read the stripes is often too expensive for most subscribers to afford. Lawrence E. Shoemaker of Diners Club explains the situation: "Let's assume a terminal costs a thousand dollars. We have well over three hundred thousand merchants. If we supply each of them with a terminal, that's a cost of three hundred million dollars. Even if those terminals saved us as much as a half-million dollars annually, it would take us *six hundred years* to amortize the costs."

Manufacturers, including Bell Laboratories which has already developed the Transaction Telephone to try to cope with such dramatic expense, are trying to surmount the current cost obstacle of terminals. But there are still problems. Not all credit cards have the stripe, so all terminals have a provision for by-passing the mag stripe reader. Small banks to not have the equipment to take advantage of mag stripe technology at all, so they don't bother with it. Yet, mag stripes do seem to offer the best security available against credit card crime, and in 1971, the American Bankers Association gave the mag stripe its blessing.

However, it seems that as fast as technology can come up with methods of preventing crime, it can also find ways of beating those methods. Citibank of New York, one of the nation's largest credit institutions, did not share the rest of the industry's confidence in the mag stripe. It challenged 22 Cal Tech teams to thwart the system and offered $15,000 as incentive to anyone who could. Citibank had to pay off 22 prizes. Phillip H. Dorn, president of a computer security firm, says that any sophomore-level engineering student could also have built at least four or five devices to beat the system out of scraps lying around any engineering lab.

As we move into a society that bases its money handling less and less on cash transactions and more upon computerized techniques of transferring funds, there seems to be even greater reason to fear electronic robbery. Experts, however, are optimistic about the future. They cite how computers, even now, help security people to spot trends and patterns in the fraudulent use of credit cards. Thus, while increased utilization of electronics and of data processing may open some avenues for a new breed of sophisticated criminal, it may also help to close off some escape routes. The crook who manages to mug a computer could be caught by that computer.

[Adapted from "How Credit Card Crooks Pick Your Pocket" by Marvin Grosswirth, *Science Digest,* June 1975.]

Waiting for the Great Computer Rip-Off

by Susan Hastings

Computers have come to be deeply and pervasively involved in the basic business functions of our society. Top executives might die off, factories blow up, foreign subsidiaries get nationalized, but if you really want to see a company president blanch, ask him what he would do if the magnetic tapes with his accounts receivable got erased. And as sophisticated electronic and magnetic data replace manually kept books, the dangers of almost undetectable large scale crime being committed by unscrupulous computer experts is becoming a serious problem for both the manufacturers and the users of even the very most secure systems now in existence.

Data stored in machines has not only replaced old-fashioned accounting systems, but it has also gone a long way toward replacing tangible assets. According to Richard Mills, a vice-president of First National City Bank in New York, "The base form of an asset is no longer necessarily a 400-ounce gold bar; now assets are often simply magnetic wiggles on a disk." For criminal purposes, anyone familiar with computers may be able to manipulate those wiggles so that funds are fraudulently credited to an account, a bank balance is programmed never to fail, or the record of ownership of very large sums is changed. One expert has said that for a criminally-minded person with a lot of skill, it's about as difficult as "solving a hard Sunday crossword puzzle," to read, alter, and tamper with intricate programs.

Computer crime has not yet been proven to be an overwhelming source of loss, but no one really has any valid statistics as to how much subversion is actually going on. There are indications, however, that a lot more crime *occurs* than is ever detected. One expert puts the ratio of undiscovered to discovered crime on the order of one hundred to one. Donn Parker, the leading expert on the history of computer crime, admits that of the nearly 175 cases he has investigated, almost all were exposed accidentally.

A classic case of embezzlement via computer was uncovered accidentally last year when New York police raided a bookie and found his best customer to be an $11,000-a-year bank teller who for weeks at a time had gambled up to $30,000 a day. The man who had access to his bank's computer terminals, would simply pocket customers' deposits and type in false information to the machine, usually transferring money from long-unused accounts. By combining such elementary computer manipulations with workaday larceny, he managed to net 1.5 million dollars before he was caught.

Donn Parker has analyzed twelve cases of computer embezzlement that occurred in 1971 and found that the losses averaged $1.09 million apiece, or about ten times the average embezzlement loss. With ever larger amounts of credit and other assets moving into EDP systems it seems inevitable that more criminally inclined people with more elaborate resources will grab for the prizes so temptingly exposed. "There are something like a million programmers in the country right now," observes Willis Ware, a computer-security expert, "and if only one per cent of these were inclined to be dishonest, that's ten thousand dishonest programmers." The fact that employee dishonesty as a cause for computer related losses in business jumped from fourth to second place in all losses in just

three years, may mean that it just takes time for dishonest people to learn how to take advantage of their opportunities. And even as computers themselves become more sophisticated, the criminals who attempt to subvert them become more cunning and less detectable.

With the advent of time-sharing and multi-access systems, there is opportunity for more far-ranging crime than was demonstrated in the comparatively elementary manipulations of the embezzling bank teller. Years ago college students began to exploit the possibilities of a system's vulnerability when they used their computer knowledge to read various instructors' stored exam questions. When that wasn't enough, they even learned to change their own grades. Nowadays few manufacturers or users are unaware of the lack of total security in any computer operations. Perhaps most disturbing in its implications is the result of many attacks waged by the Defense Department's "tiger teams", who try to penetrate systems being considered for defense. So far, there is no major system that has been able to withstand a dedicated attack.

Manufacturers believe that their computers can be made more crime-proof, but to do so will be expensive in both hardware costs and user convenience. Alternatives to the often laughably weak password defenses are being considered: some companies are working on devices that will only recognize a personal insignia such as the shape of a hand. Wiretapping might be avoided through the development of message scrambling devices, but the problem here is that a really ambitious criminal could use his own unscrambling computer to defeat such a device. However, even as these and many other security devices are being developed, experts are beginning to admit that a sophisticated and highly motivated thief is not likely to be deterred for long. Manufacturers say that it's pointless to bring out new systems capable of resisting attack until their customers adopt better physical security measures in their own installations as well as better screening of computer employees. Considering that it's the employees who not only have the most access to computer data, but also know the most about the intricacies and weaknesses of the systems, one can understand Robert Jackson's suggestion for preventing crime: he speculated that the first step might be to "shoot the programmer."

[Adapted from "Waiting for the Great Computer Rip-off" by Tom Alexander, *Fortune,* July 1974.]

Turning On With Computer Art

A Report on the Third International Computer Art Festival

Sema Marks
City University of New York

The Image of the Computer

Computers permeate society. Yet for many people they remain mysterious, threatening, or, even worse, "evil." Unfortunately, many applications of computers most visible to the public reinforce these stereotypes and convey a decidedly unfavorable image.

When this circuit learns your job, what are you going to do? asks a public service ad displayed in buses and subways.

Applications and questionnaires: *Current salary? Have you ever contemplated suicide? Are you now or have you ever been . . .?* Computers invade our privacy. They send us bills and junk mail and foul up our charge accounts. They hold us accountable for our expenditures. They seem to monitor us. Information systems enabling womb-to-tomb surveillance are causing a serious dichotomy between our democratic heritage of individual freedom and privacy, and business and government's need to know.

Many negative feelings towards computers probably emanate from a long tradition of hostility and suspicion about technology which in any way simulates human behavior. Consider the tradition of Frankenstein and Golem. While modern day Luddites may only express their feelings by folding, stapling and mutilating punch cards (rather than smashing laboratories), they nonetheless express the view that sabotage and destruction are man's only means for dealing with these "malevolent beings."

Clearly we must face up to the problem of the computer's public image, for computers are here to stay and are becoming increasingly important in all aspects of our daily and professional lives. Ironically, it is precisely the computer which will enable man to manage and control the accelerating technological society of the future.

On one level, computer literacy is simply a question of being "in" or "out." The world is already divided between those people who know about computers and those who don't. Where some have access to computers and others do not, the balance of power, efficiency, and knowledge which can be brought to bear on a problem is clearly tipped in favor of the man-machine partnership. Knowing about computers today is a valuable asset; tomorrow it may be a matter of survival.

As we move further into the computer age and computers become more accessible to the general population, we must look for ways to turn people on to computers, their applications, their benefits. One strategy is a surprise move, a tactical end run, interesting people in computers in unexpected ways.

Computer Art

Introducing people to computers through their use in the arts is one tactic. Few know that computers can fit into *that* world. Computer art broadens people's views of what computers are all about. Many people who can't relate at all to tables of prime numbers can spend hour after hour happily listening to computer music and speech songs, and viewing computer films and videotapes.

I am using the term "computer art" to refer to any work – film, videotape, music, graphics, holography, poetry or sculpture – in which the computer plays an important role. Artists use computers for many different reasons. For some the computer provides more control over the processes and procedures they are currently using. Composers of electronic music, for example, have turned to the computer to "record" their productions. Analog synthesizers have no memory, hence they provide no way to exactly reproduce an electronic music score. Once a computer program exists, however, the composer can listen to a piece and make subtle or strong changes; he can interchange voices, slow down or speed up the tempo, and make insertions in the score.

Pierre Boulez, the noted composer and conductor, has been learning to use the computer as a new musical instrument and composing device. "You begin to compose sounds in your head and you build from experience to know what will happen next," he said. "The computer is exciting because it can be both the score and the instrument at the same time." In a total computer music system, the computer is able to generate, analyze and interpolate any sound imaginable.

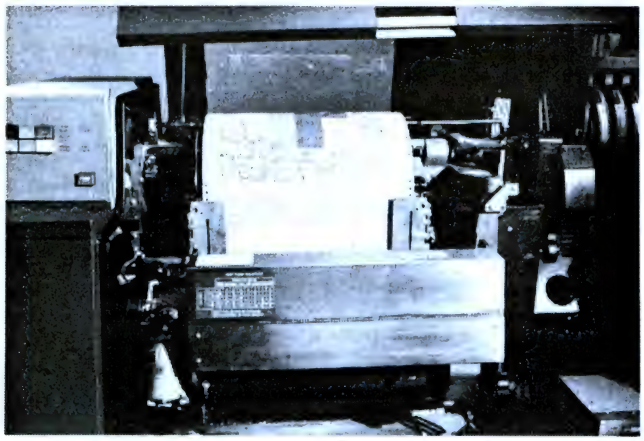
[More about computer art and the views of computer artists in the special May-June 1976 art book issue of *Creative Computing*]

International Computer Art Festival

Many examples of computer art – computer music, films, videotapes, poetry, graphics and sculpture – were shown and discussed at the Third International Computer Art Festival held at the Graduate School and University Center of the City University of New York from June 12–21, 1975. Through a series of workshops, seminars, and live performances, over 1200 people shared in the world of computer art.

The quality of the work shown and demonstrated varied considerably from what might be considered "five-finger exercises" to commercially acceptable productions. "Hun-

Computer programmer and film-maker Ken Knowlton explains EXPLOR to his class. (Photograph: Louis Forsdale)



Coming off the line printer. (Photograph: Louis Forsdale)

ger," for example, a computer-animated film by Peter Foldes won the Special Jury Award at the Cannes Film Festival in 1974 and was nominated for an Academy Award in 1975.

My own involvement with the Festival as Director of Academic Computing of CUNY was not so much prompted by the present esthetic and technical qualities of this new medium, but rather on the belief that this is a significant new dimension with virtually unlimited artistic and scientific possibilities that need to be fostered and developed.

> *Our time is a time for crossing barriers, for erasing old categories, for probing around. When two seemingly disparate elements are imaginatively poised, put in apposition in new and unique ways, startling discoveries often result. Marshall McLuhan and Quentin Fiore.* The Medium is the Message.

My principal interest in computer art and the Festival, however, was as a tactic for interesting those people who have no reason to believe that they should have an interest in computers and computer art, or who are hostile out of ignorance to embrace the medium as a friendly tool rather than as an enemy or something beyond comprehension.

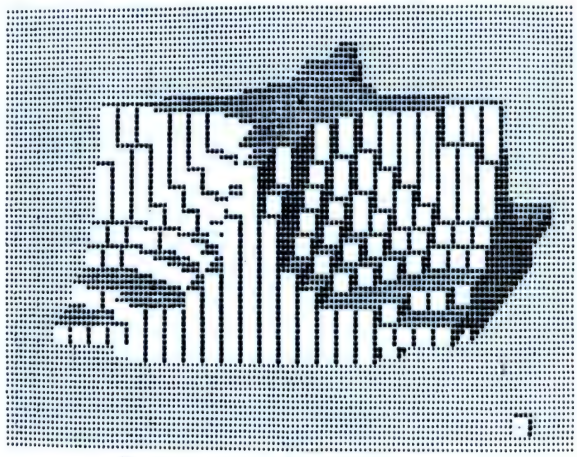
The Festival demonstrated that computer art is a very good way to turn people on to computers. Like computer games, computer art involves the "user" (sucks him in? hooks him?) in a non-threatening way. Computer art is theater. It provides entertainment. It absorbs the user and arouses his curiosity.

How does it work? How did he do that? Does he just push buttons and hope that something interesting will come out? How involved is the artist anyway? These questions are easily answered, particularly with some hands-on experience as we provided at the Festival.

Adding a personal touch. (Photograph: Louis Forsdale)

Artist and respecter-of-art both learn rather quickly when confronted with a computer that one doesn't just push buttons and pray (or engage in some other undisclosed mathematical mumbo-jumbo). Rather one *interacts* with his tool as every artist must interact with tools: the painter with brush, canvas and paint; the musician with a variety of instruments; the dancer with time, space, and body. These are understandable concepts, easily demonstrated. Even a writer needs a pen, pencil or typewriter. Tools and art are in no way incompatible. On the contrary, art exists only in and through the use of tools, including computers.

We demonstrated this to a broad mix of people under the tutelage of Ken Knowlton, a researcher at Bell Telephone Laboratories and creator of several programming languages for the production of computer graphics. Some of the participants knew computers, but not much about the uses of computers in art. Some knew art, but didn't know how the muse could be served by those electric circuits. They effectively complemented each other, each giving what he could to his fellow students.



Student output using EXPLOR.

Ken taught them EXPLOR, a simple and easy-to-learn computer language for the production of graphic design, and we provided them with hands-on capability to exercise their knowledge — keypunches, terminals and the other accouterments of computer art. Excitement mounted over the five days of the workshop as the walls filled up with student-produced graphics of great variety. This evolving "exhibition" was one of the most gratifying features of the Festival.

Testimony of the participants, just watching them in fact, showed that they did become involved with computers, some of them for the first time in their lives. My own suspicion was that the participants changed their views about computers in many, many ways.

For those previously antagonistic towards the technology, there was a decided shift from the Frankenstein stereotype in which the monster had to be killed for man to survive, to one in which man and the computer could work happily and productively together, to achieve what neither could do alone.

The workshop was a success. The participants were turned on to computers. But what had they learned?

They learned that artists use computers. And, as one person pointed out, "If artists (who are stereotypically the complete antithesis of the traditional computer programmer) can use a computer, anybody can."

They learned that the computer could be a useful tool. It could extend their creative abilities in much the same

New Communications Media

Can we account for the human dimension?

*Condensed from a paper of the same title by Robert Johansen given at the World Future Society Second General Assembly. For a free copy, write Institute for the Future, 2740 Sand Hill Road, Menlo Park, CA 94025.

The new communications media, especially that of computer conferencing, has produced new and systematic ways of understanding its human implications. In researching group communications, experts have found that they can pinpoint three overall patterns of influence in the new media. For simplicity's sake they call them the Great Thinker, the Social Accountant, and the Technology-Firster.

The Great Thinker has the ability to look at overall patterns — to mentally grasp a totality and express it in a way that others can also see. But it is usually a very general vision; it is often highly debatable; it is sometimes naive. Great Thinker approaches usually lack detailed information or experience; however, they play the very important role of assumptions-questioners and visionaries. Their effect on new media is felt only on a general level, but it is an important effect. It would have taken a Great Thinker point of view in 1945, for instance, to view the computer as anything but a number cruncher. Computers are now communications media as well, though most people *still* view them as primarily number crunchers. We need ways of broadening our own vision about current examples of infant media — perhaps still including the computer.

The Social Accountant seeks to evaluate a new medium of communication *before* it is released to the general public in order to precisely measure its social effects in a controlled environment. The problems with his outlook arise in trying to generalize from the laboratory to the "real world". The tools of social accounting, however, are often invaluable and may be the only systematic processes available.

The Technology-Firster argues that one can never estimate the social effects of a new communications medium until it is actually being used on a large scale. The failure of the Picturephone is an example of the Technology-Firster gone wrong. However, there is a basic truth in the position of the Technology-Firsters: new media of communications cannot be *fully* understood until they are in real use over a period of time. Technology-Firsters are usually very good planners; they just aren't social planners.

Taken alone, all three approaches to technology lack the vitality or comprehensiveness necessary to plan for human communications such as those likely to occur in the near future. A hybrid among them however, is not only possible, but may be the only serious hope for adequate accounting of human factors related to the new communications media. The resulting approach would operate in the following ways:

1. Maintain a sense of larger social implications as practiced by Great Thinkers, but make sure it is linked to processes for developing and applying new media.
2. Develop the measurement and evaluation sophistication of Social Accountants, but don't be afraid to leave the laboratory.
3. Keep closely tied to the operational know-how of Technology-Firsters but try to keep human issues on an equal footing with technology.

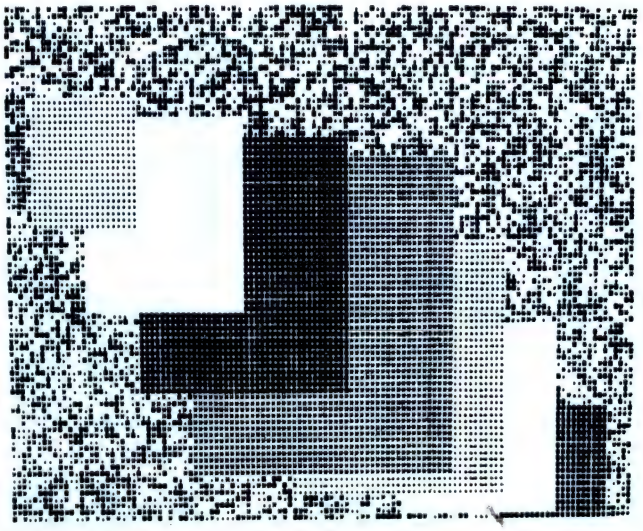
Computer Art continued —

way as the telescope or miscroscope extends their vision. They had entered into a productive partnership with the computer. They had put the computer on.

> *The computer is by all odds the most extraordinary of all the technological clothing ever devised by man, since it is an extension of our central nervous system. Marshall McLuhan and Quentin Fiore.*

And they learned EXPLOR, a means to control the machine and have it do their bidding. Many have gone on to use EXPLOR to experiment with graphic design for the production of silkscreens and needlepoint. Others have gone on to courses in FORTRAN (the language in which EXPLOR is embedded) to enable them to have still more control over their end-products. And all will view computer art, particularly graphics, from a new perspective, now having a deeper understanding of what went into it.

There are many portals to the world of computers. Some people will choose one doorway, some another. For many, as the Festival demonstrated, computer art is a most inviting, comprehensible, even compelling entry point.



More output using EXPLOR.

Community Memory: A Public Information Network

After twenty-five years of computer development, the question is still open as to whether this technology can be directly useful to the public. People at present generally believe that computer systems are used on them rather than for them. The few public-access systems are vertically organized, conceived primarily for delivery of computer-aided instruction and other pre-selected information, as thoroughly edited as other forms of mass information. Horizontal programs, although largely unexplored, would allow the public to take advantage of the huge and largely untapped reservoir of skills and resources that resides with the people. A critical context for use of such a system would be in community based information centers rather than terminals located only in private homes.

For the last year the Community Memory Project has been demonstrating the potential of computer-based public access communications media with a small network of public terminals in the San Francisco Bay Area. From any terminal it was possible to search a common data base using boolian combinations of keywords or to add and index new information/messages of whatever nature the user desired. Both the ease with which the public accepted the service and the imaginative uses to which it was put were surprising and gratifying. The project is currently developing hardware and software systems to move the idea from an externally financed experiment to a cheap, self-sufficient service available to everyone in the Bay Area. These systems would supply the basic tools for establishing similar services elsewhere, and provision is being made so these regional networks could be linked to form a continental information sharing network.

People in the Bay Area accepted the Community Memory Project with remarkably little hesitation and put it to a much broader range of uses than was anticipated, proving that given the tools, the public will not only provide for its own information needs but will do so with great creativity. The first of three terminals was installed adjacent to a bulletin board in a non-profit community record and music store in Berkeley. People were delighted by the chance to put a computer to use. They encouraged their friends to use the system, instructed one another in its use, and seemed fascinated as much by the possibilities of the medium as by the technology itself. The level of acceptance was not confined to the relatively sophisticated student area, but carried over to later installations such as one at a library in San Francisco's polyglot Mission District.

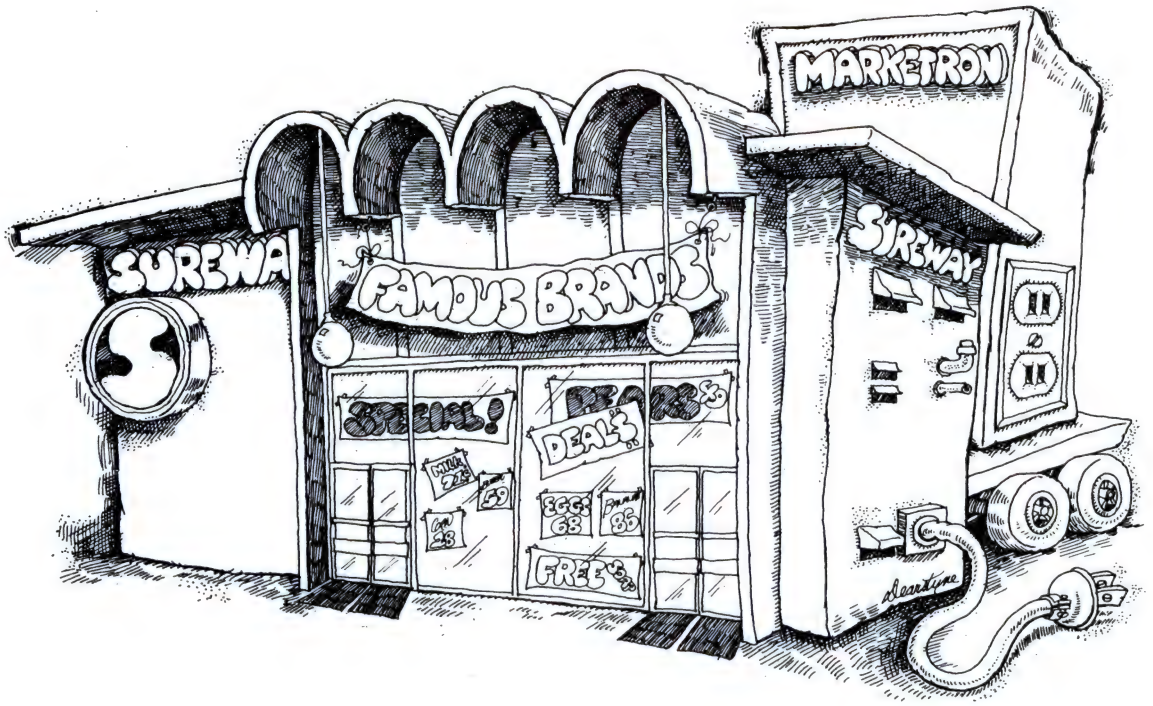
Students began to use the system immediately in their search for housing, and as use of the system grew, so too did its data base. Musicians found others to practice with, buyers and sellers of instruments, and were even able to form new groups. People began to use the system to assemble car pools, organize study groups, find chess partners, and pass tips on good restaurants. More exotic uses developed: experiments were made with poems, graphics and items almost analogous to letters to the editor, but much freer in content and form. Instant publication by a "very small press" became available to all who professed literacy.

As the rate of usage and the diversity of roles of the system increased almost daily, its inherent deficiencies began to appear and offered technicians opportunities to develop and perfect the system. Although misuse of the system was not prevalent, it began to appear that malicious and obscene items, trivia, and misinformation represented the major opportunities for its abuse. Inexperience on the part of the users with typewriter keyboards, spelling errors and misunderstanding the keyword concept used presented other problems. These and other deficiencies encountered in the operation of the pilot system could be efficiently dealt with through redesigned software systems, but at the present moment, the system's efficient use really depends more upon maintenance of conviviality in the interactions of the users. It is necessary for the general public to gain a clearer sense of understanding and control over the system as a tool.

The pilot system, supporting a few terminals on a large, expensive general-purpose time-sharing computer, was not economically reasonable. It appears that by using an optimized file structure, good searching procedures, and a thoughtfully coded, mostly core resident program, more than 64 simultaneous users could be serviced by a 24K mini computer the speed of a NOVA or PDP 11/40. Such softwear is currently being developed along with custom terminal multiplexing hardware which will greatly reduce the load this many terminals place on the CPU. With the broad base for capital and maintenance costs this system provides and the use of a low-cost, people-oriented Tom Swift Terminal, costs should be less than $2000 per public access site.

The cooperative use of technology to meet human needs, rather than its competitive use to create lucrative mass markets is the basic goal of the Community Memory project. The issues of how and for whom the technology will be made to perform are becoming ever more critical. They play a deep role in the continuing economic, ecological, political, and energy crises. These issues must be dealt with by both the people who have mastered and currently control the technology and those people the technology claims to serve.

[Condensed from the *Journal of Community Communications,* Vol. 1, No. 0. Send 20¢ for copy to LGC Engineering, 1807 Delaware St., Berkeley, Ca. 94703.]



Why Supermarkets Are Going Bananas Over Computers

by Chris Barnett

Better profits in the long run, and shorter lines at the checkstand. Will It Really Work?

One Saturday late last June, Jim and Sharon Roberts of Troy, Ohio, noticed something strange when they walked into Marsh's Supermarket to do their weekly shopping. The checkers weren't pounding on the cash registers like they normally do. Instead they were simply sliding each item across a smoky glass window built into the newly installed checkstands.

Just by passing the item across the glass, the price automatically appeared on a readout sign, the untouched cash register recorded the sale and the register tape spelled out each item purchased, sometimes by brand name, along with the price.

Reprinted courtesy United Airlines *Mainliner* Magazine. Copyright 1974 East/West Network, Inc.

The Robertes quickly discovered that their neighborhood supermarket had been turned into a laboratory; National Cash Register Company and Marsh's Supermarkets, Incorporated, had selected the Troy store to test some unusual new equipment. An electronic scanner that automatically "reads" a code affixed to every item in the store, feeds everything it reads into a computer in the backroom and gives manager Earl Frysinger a mountain of facts and figures designed to help him run the store more effectively and more profitably had replaced the good old cash register.

What's more, the test results at the Marsh's store, together with findings of other market tests of additional scanning equipment around the country, are destined to have a devastating impact—not only on the lives of millions of American shoppers but on the entire grocery industry—wholesalers and retailers as well as the manufacturers of every item you find on your foodstore's shelves.

Overstatement? Figure it out for yourself. At this very moment salesmen for over a dozen of the nation's biggest or most aggressive business machine and data processing equipment makers are amorously courting retail food chains to persuade them to computerize their checkout systems, indeed the entire store operation—from buying to inventory control to cash flow.

The retailers, cautious but not all that skeptical, recognize they can no

Illustration by John Dearstyne

longer be leery of the computer, the magical machine that's cut costs, beefed up production and delivered decision making data for so many other industries in today's business community. In boardroom after boardroom, food chain executives, who've traditionally resisted automation for a handful of reasons, are making major decisions to commit mammoth amounts of capital in a last ditch attempt to fatten their wafer-thin profit margins.

The Postage Stamp Code

But for the first time, food chains are possibly finding it a little easier to make that "go or no go" decision. It all appears to hinge on a code the size of a postage stamp that is revolutionizing everything. It's called the Universal Product Code, and thanks to a massive cooperative effort by virtually every American grocery product manufacturer, the UPC will be "source marked." In other words, the price code is put on at the plant, not stamped on at the store. This alone should result in considerable savings (some say 20 percent) in labor costs.

Not surprisingly, UPC implementation is not happening overnight. Nevertheless, the Uniform Grocery Product Code Council, with its 1300 company members representing a collective $63 billion in annual retail sales, has pulled out all the stops to get it moving.

Spurred on by an outfit called Distribution Codes, Incorporated, tabbed to ramrod the project, the code, adopted industrywide in April, 1973, should be on the labels or packages of 50 percent of the stores' shelf stock by year end. If all goes according to plan, 80 percent of the products should be source marked by midyear to fall of 1975. Once source marketing hits 80 percent, many scanning equipment makers think the food chains will be banging on their doors.

Meantime, there is plenty of groundwork to be laid. Manufacturers of the Point of Sale (POS) equipment have lots of selling to do. Many of the equipment makers have proven the benefits of POS, including scanning, to the general merchandise or nonfood sectors of retailing. Singer, whose Business Machines Division claims the leadership position (with over 50 percent of the market) in POS, has long served retailing giants like J.C. Penney and Sears, Roebuck; now it's scrambling for supermarkets.

Also in the race is Litton Industries' Sweda International Division, a major factor in retailing POS systems here and abroad; Sperry-Univac, which conducted the historic Kroger test and thus the first maker to scan a code; the ESIS Division of Bunker Ramo, said to be the leader in electronic information systems for supermarkets; and National Semiconductor Corporation, a highly aggressive Santa Clara, California, concern. Then, of course, there is NCR Corporation (new name for National Cash Register, a retailing household word that is reportedly number two in POS).

Almost all the foregoing firms offer a modular approach—an electronic cash register (either stand alone or hooked to a minicomputer in the backroom) that can be upgraded to a scanner setup when the store, the manufacturers and the public are ready.

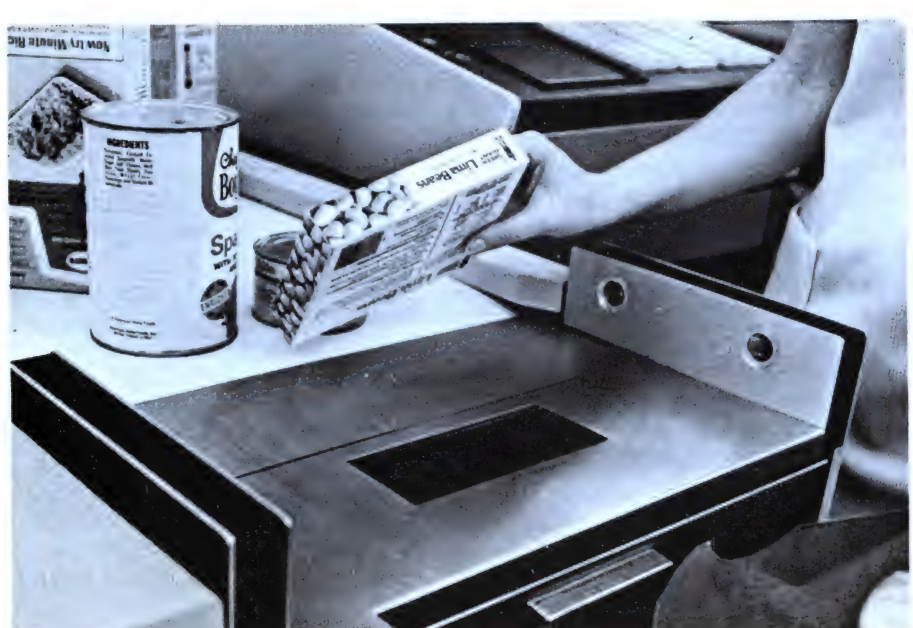
All or Nothing

A comparatively late entry to electronic POS is giant IBM Corporation, which has introduced both a supermarket and a general merchandise version. As might be expected, IBM is taking an altogether different marketing approach, at least in the grocery field. The big computer maker produces the terminal or cash register and the scanner but it will not sell them separately. Its supermarket system, dubbed the 3660, also includes a "store controller," a backroom minicomputer that monitors and memorizes the activities of up to 24 terminals and scanners. Buy the whole package or forget it.

Other firms are going their own way, too. MSI Data Corporation of Costa Mesa, California, has welded together a team of grocerymen and data processing types and are wooing supermarket accounts exclusively. The hardware, of course, is heavily pitched, but the company also stresses a series of software programs aimed at showing the manager how to use his newly collected data. Still others that have developed supermarket scanner systems include Data Terminal Systems, Incorporated, of Maynard, Massachusetts, and Norand Corporation of Cedar Rapids, Iowa. But the POS makers realize that selling the retailer is only half the sale. Most companies are vitally concerned with the reaction of the shopper. Electronic cash registers have made some headway in speeding up the lines at the cash register but the scanners should make them move even faster, believes Charles S. Adams, senior vice-president—marketing for Sweda International in Morristown, New Jersey. "It should also provide for greater accuracy at the checkstand and fewer missrings since the terminal automatically 'looks up' the price of each item."

No More Waiting?

Some retailers also think the scanner systems will put an end to many of their customer complaints. "Studies have indicated that waiting to be checked out is high on the list of customer aggravations," says John Rob-



Scanning foodstuffs becomes a piece-of-cake for checkers, with no need to line up item and machine. Photo courtesy of NCR Corp.

ertson, vice-president of information systems for Ralphs Grocery Company in Los Angeles. "We hope customer delay at the checkstand will be minimized by automatic handling of some of the more tedious transactions like check cashing, coupon redemptions, bottle returns and food stamps."

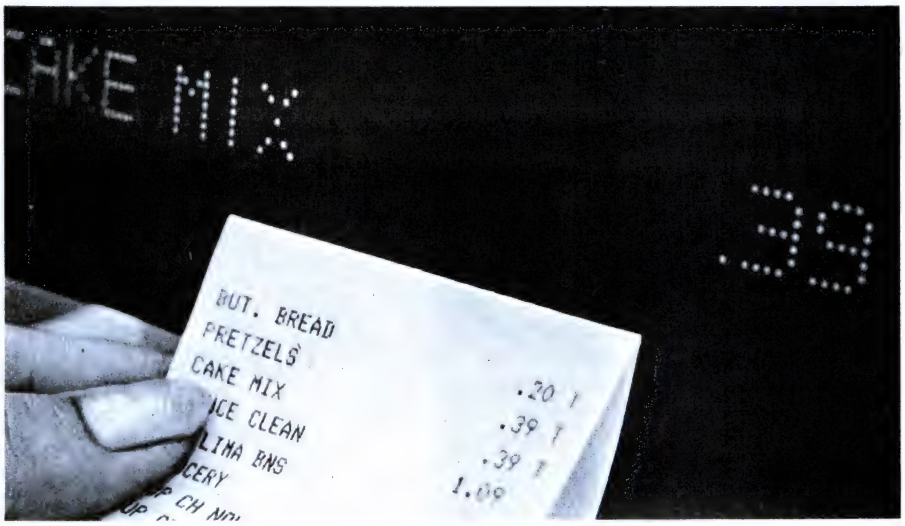
Ralphs, which planned to test the IBM 3660 system in its Lakewood, California, store last month, is pushing hard on customer service. "Accuracy is the big word," notes Robertson. "With the prices of most items retrieved from the store computer, the customer will not miss any sale or promotional price, and will always be charged the correct amount of sales tax on the correct taxable item."

Some consumer groups and other vocal shoppers have already registered their displeasure with the move to automate grocery checkstands. They have no objections to swift moving lines or the automatic dispensing of trading stamps. What they are objecting to is the grocery industry's concerted move to eliminate price stamping on each item.

Complains one Chicago housewife: "I just can't imagine going into a store and comparing can goods where there is no price marked on the top. You can't compare the codes, I understand, and the shelf tags are always jumbled up. I don't know how it's going to work. I just don't see it."

Jim Roberts, the Troy, Ohio, policeman who likes to "go to the grocery store" with his wife Sharon, agrees. Commenting on the test now underway at Marsh's, Roberts reports that the scanners "don't pick up all the prices all of the time." Evidencing a basic distrust of computers, he says the "worst thing they could do is take off all the old prices. If the thing (the scanner) is not set right, it could be eating you alive and you'd never know it."

Store manager Earl Frysinger says the test at Marsh's is going "very well. It's given us faster front end service and more accurate cash control, plus it's simplified our office bookkeeping." How are customers reacting to the test? "We haven't had too much controversy," he replies. "But, then, we held a meeting with 24 housewives beforehand and explained it to all of them." Still, every item in the store is double priced—UPC coded and stamped on top. Mr. Frysinger has no idea when he'll drop the stamped price.



What your "new" shopping receipt might look like after the computer computes it. Photo courtesy of IBM Corp.

Probably not for a long while. Robert Cottrell, vice-president of store operations for The Kroger Company of Cincinnati, reported that its experimentation with RCA on automated checkout (since taken over by Sperry Univac) showed that shoppers react "negatively" when the prices are scrubbed.

"The removal of individual item pricing on dry goods," he explained in a recent report, "as expected, resulted in significant declines in the rating of the Kroger test store for 'adequate price information.'" Shelf strips are not a fully accepted replacement for item pricing, he added.

Clearly, the price stamping question is a hot potato now and few POS equipment makers are willing to address themselves to it publicly. Others, like Richard Baily, president of the Singer Company's Business Machines Division, takes the more positive approach and contends that it will take some patience and education, but within a couple of years at most, coded items will be smoothly sailing across the scanner and no objections will be heard.

Patience and education seem to be the watchwords today when it comes to POS and particularly scanning. As noted earlier, retailers are clearly interested; scanning equipment makers drew record crowds at the Super Market Institute's convention in Dallas last May. But price is a stumbling block for many chains. Price of an eight terminal IBM system at the Dallas show was $118,760, according to Supermarket News, the industry tradepaper, while Univac asked $106,700 for a five checkout lane scanning system.

Nevertheless, some chains are putting their toes in the water and going the minicomputer-linked-to-an-electronic-cash-register route. Singer, for example, has signed Mayfair Markets in Los Angeles; Sweda International has a contract from Albertson's of Boise; National Semiconductor is working closely with Alpha Beta throughout California and Arizona and NCR Corporation has a half dozen client grocery chains including A&P and Public Super Markets, as well as Marsh.

Others like National Tea Company of Chicago (515 supermarkets in the Midwest and central United States) are going to have to be shown. "Scanning is still kind of nebulous," shrugs John Loper, vice-president of construction. "We don't know who is going to emerge with the best equipment." Loper thinks scanning would work best in a new store. "It's too expensive to install it in an existing store." The chain is testing two electronic cash register/minicomputer systems, one in Chicago, the other in St. Louis.

What are the Goliaths of the food retailers doing? An A&P spokesman says nothing concrete is happening in connection with POS systems. Meantime, on the West Coast, Oakland-based Safeway Stores is still mulling over the results of an eight-month scanning test completed a year ago. It was installed, said a formal company statement, "to evaluate the degree of improvement such a system can provide in the actual operation of a supermarket."

How did it go? Replies a Safeway spokesman: "We don't have anything to say."

CREATIVE COMPUTING

Reviews

Reviews Editor: Peter Kugel, School of Management, Boston College, Chestnut Hill, MA 02167.

Readers: Want to be a reviewer? Write to the Reviews Editor directly. Publishers: send materials for review to the Reviews Editor.

The Digital Villain: Notes on the Numerology, Parapsychology, and Metaphysics of the Computer. Robert Baer. 187pp. Addison-Wesley Publishing Company, Reading, Mass. Paper. 1972.

Don't let the title scare you off. This gets a four star rating for those who know all about computers, and a three star rating for those who do not. The author begins by saying that we invented computers to solve the problem. What seems to have happened is that computers have become the problem. Good references throughout. A most thought provoking book. Includes: The Semantics of Computer Science. Computer Pre-history: 1663 and all that. Turing's Mini Super-Computer. The Road to Bitsville. The Golden Bit. Games Computers Play. Playing the Game. Computer Pretense: the simulation extended. Tricks Computers Play. Artificial Intelligence and Intelligent Artifice. Rossum's Universal Robots: man as machine. The Desk Set: man vs. machine – the last victory. Billion Dollar Brain: the computer as espionage agent. Hour of the Robots: the computer as lover. The Tin Men: the computer as sportsman, moralist, and writer. Giles Goat-Boy: the computer as the military-scientific establishment. 2001: the computer as travelling companion. The Tale of the Big Computer: the computer as Chaucer or how the opposition sees man.

Peter Olivieri
Boston, Mass.

* * *

Databanks In A Free Society: Computers, Record-Keeping and Privacy, Westin and Baker, Report of the Project on Computer Databanks of the Computer Science and Engineering Board; National Academy of Sciences, New York: Quadrangle / The New York Times Book Co., 522 pp., $4.95, 1972.

This book is the report of a massive study, conducted between 1970 and 1972, on how databanks are actually being used in our society and, based on that, how use of databanks is likely to grow. Particular attention is paid to the area of civil liberties and privacy. Attention is focused on the question of whether advanced use of data processing has actually caused organizations to change their old policies and on whether present policies and legislation are adequate to ensure the rights of the people in the computer age.

A review of current data processing technology is included for those not already familiar with the area and the methodology of the study is clearly explained. Almost half the book is used to present the profiles of fourteen organizations which make extensive use of computer databanks, detailing how they make use of computers and how this use has changed their methods of operation. Included are such organizations as the Social Security Administration, the Bank of America, the Church of the Latter-day Saints and a municipal and a county government.

Following the profiles are presented the findings of the study. These cannot be adequately summarized and should be read by anyone seriously concerned with the area of the study. Many of the Project's findings are reassuring, but the report warns against being lulled into a false sense of complacency. Very real problems exist, primarily because our legal system has not moved with near the speed of computerization.

Although this book is hardly casual reading, it should not be missed by anyone concerned with the problems of databanks and privacy. As the first extensive study of its kind, it contains a wealth of information and will serve as a baseline against which future studies will be discussed.

John Lees
Rolla, MO

* * *

The Terminal Man by Michael Crichton. Alfred Knopf, Inc. New York, 1972. $6.95.

This novel combines authentic description with hair-raising suspense to open up for the reader a new area of modern science: surgical-computer mind control.

Psychosurgery is performed on a violent paranoid who has twice attempted to kill. A team of surgeons conducts a delicate operation, connecting 40 wires from the patient's brain to a microminiature computer implanted in his neck. It is the job of the computer to detect the start of a violent seizure and prevent it by stimulating a pleasure or calm node of the brain. The tension builds throughout the book from the initial conflict between the doctors to the final terrifying results when the patient escapes from the hospital before the computer program is tested.

Psychosurgery of the kind Crichton describes is already taking place in medical research centers today, thus making mind control a key scientific and moral issue of our time. Crichton takes it out of the realm of the abstract, and makes immediate its workings, its dangers, and its implications in a novel that provides urgent information and superb entertainment.

David H. Ahl
Morristown, NJ

* * *

The Electronic Criminals. Robert Farr. 194pp, $8.95. McGraw-Hill, New York, 1975.

Based on the author's experiences as a writer and as an expert in the field of computer fraud and industrial criminology, he details Ponzi schemes, technically sophisticated rip-offs, stock swindles, modern embezzlement methods, and out-and-out thefts using modern technology.

The Stanford Research Institute estimates that between 1967 and 1972 some 50,000 major crimes were committed worldwide with the technological assistance of computers, telecommunications devices, photocopy equipment, lasers, jet transportation, and so on. This broad spectrum of devices (with the exception of the jet aircraft) is covered in this book relegating computers, therefore, to a rather modest role.

From a sociological standpoint what is probably most interesting is the author's observation that such nefarious

activities are a sign of the times. "More and more people freely admit, indeed positively boast, that they are not loyal to society and do not intend to serve its interests." This attitude is probably not new, but the openness in expressing it is. Indeed, for years our moral attitudes toward crime account for a peculiar ambivalence toward criminal behavior itself. On the one hand, it is feared, despised, and vigorously condemned. Yet it is also secretly admired, and we are always eager to hear the details of some outstanding criminal exploit. While not quite as lively as *The Godfather,* or *The Great Train Robbery, The Electronic Criminals* nevertheless will give you some insight into the emerging types of crimes, one of which almost assuredly by 2000 will have the title, "The Crime of the Century."

David H. Ahl
Morristown, NJ

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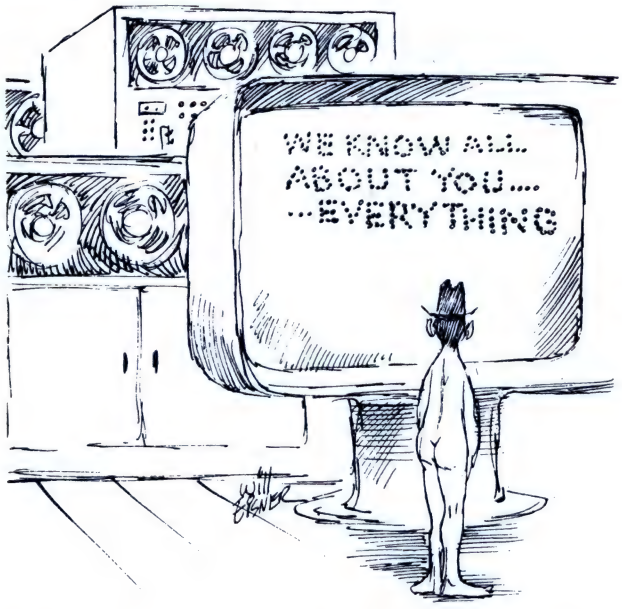
Freedom's Edge: The Computer Threat To Society, by Milton R. Wessel, 137pp., $4.95. Addison-Wesley Publishing Company, 1974.

"A communications medium transmits messages. It also may affect the message itself.

"A computer system processes data. It also may affect the data itself. It is the theme of this book that when the computer's impact on the data is great enough, it changes the environment in which we live."

It is symptomatic that some people still insist that the time in which we are living be labeled "the atomic age" instead of "the computer age." Both technologies are approximately thirty years old, but while uses of atomic power are still almost nil, computers and data processing are so much a part of our world that we rarely even notice their existence. Therein lies a danger. Therein lies the threat to society.



In many ways computers are a unique invention; a general purpose invention. Computers do not simply affect one industry, nor one segment of society, nor one country. No aspect of our culture is left untouched: business, recreation, art, religion; they are all becoming computerized. Beside the influence of the computer, that of the omnipresent television set pales to insignificance. Perhaps in all of history only the invention of the printing press can compare in impact, and if you live in a large city you will find that the type in your daily newspaper is set by computer.

Milton Wessel is saying that we are right now tightrope walking on freedom's edge. The increase in use of computers is nothing short of phenomenal. In a very few years the pattern of the future will be set, and for the most part *we do not realize what is happening to us.* Computer usage is so all-pervasive that only rarely does someone catch a glimpse of the whole picture and this is usually a trained professional, not the person in the street whose future is at stake.

Wessel's book is not technical in nature, but sociological. It is primarily a book of unanswered questions and very, very tentative suggestions. It is a quite readable book and assumes no technical expertise on the part of the reader. Wessel is himself not a computer professional but a lawyer. He has spent much time involved in the legal side-effects of a computerized society and much of what he has seen worries him.

Wessel is not opposed to computers. That is not the question at issue. Our modern lifestyle is absolutely dependent on the computer. Wessel is repeating a plea which has been raised many times in the past and is best summed up in the too often ignored motto of the Sierra Club: "Not blind opposition to progress, but opposition to blind progress." At this time the growing use of computers represents blind progress.

What we are blind to are the side-effects of computer usage. Most computer systems perform quite well the tasks they were designed to perform. But what else do they do? Wessel's point about a computer system affecting the very data it is processing is not a fear that some machiavellian computer is going to run amuck a la science fiction horror story. The point is that the very fact that the data is intended for computer processing will change that data; the manner in which it is collected, the manner in which it can be used, the manner in which it can interact with other data.

We have already seen this in the privacy issue; a data bank of personal information may have many uses other than the one for which it was explicitly designed. Other problems haunt the future. The computer credit card cashless society is almost upon us. It will be convenient. But it could also mean that a person cannot buy so much as a piece of bubble gum without that fact, and time and place of purchase, appearing in some data bank. Where were you at 7:23 p.m. the night of August 18, 1984? Hmmm, you were buying a copy of *Freedom's Edge.* Flag that person as a possible subversive!

Wessel gives many more examples, some less obvious, and raises many more questions, but they all boil down to one thing. When our society becomes one massive data processing system, will we be able to hold on to our individuality and our freedom? What if I do not *want* a computer credit card? Will I have a choice?

John Lees
Rolla, MO

* * *

Zen and the Art of Motorcycle Maintenance. Robert M. Pirsig. 406 pp. $2.25. Bantam Books, New York. 1974 (Paperback). Hardcover edition published by William Morrow & Co., Inc., New York. 1974. $7.95.

How, you might wonder, did a review of a book with a title like this get into *Creative Computing?* The reason is that this book has as much to say about computers as it does about either Zen Buddhism or motorcycle maintenance.

This is a novel, but is has more philosophical content than character development or plot. What it is primarily about is the relationship between people and machines. The main machine in the book is a motorcycle, but it could just as well be a computer. It is pretty obvious from reading the book that both Pirsig and his hero have dealt with computers, mainly from the technical writing end.

According to the author's view, there are two basic ways that humans understand their world and their machines. The "classical" way looks for the basic underlying forms while the "romantic" way looks mainly at the immediate appearances. Riding motorcycles is basically romantic and maintaining them is mainly classical. The romantic mode is "primarily inspirational, imaginative, creative. Intuitive feelings rather than facts predominate". The classical mode "proceeds by reason and by laws".

The main problem, as Pirsig sees it, is that these two modes of thought don't get along together. To the romantic, the classical mode seems "dull, awkward and ugly" and to the classical person, the romantic seems "frivolous, irrational, erratic, and untrustworthy, . . . shallow".

The big trouble arises because people tend "to think and feel exclusively in one mode or the other" and in doing so tend to misunderstand, not only each other, but one half of the world. If, suggests Pirsig, we could only go back and put both of these modes together, as they were before Plato and Aristotle broke them assunder to make Western Thinking and Western Civilization possible, we might be happier.

This book doesn't have much of a story line. A man and his son ride across the Western part of the U. S. on a motorcycle. The man has had a mental crack-up followed by electroshock therapy. Now he has trouble remembering his past, some of which he encounters along the way. That's about it at this level. But this is a book of ideas and, at this level, the three main characters are three basic ways of thinking about machines. In addition to the classical and romantic modes, there is the mode that looks, not just at the form and not just at the immediate appearance of things, but at something that Pirsig calls (misleadingly, I think) Quality. "The Quality he was talking about" writes Pirsig, "wasn't classic Quality or romantic Quality. It was beyond both of them". Frankly, it was beyond me too, but that probably is because I am hung up at the level of the classical-romantic dichotomy and can't get beyond it.

The second half of the book has this Quality as its major intellectual character and maybe this is why I found it so much less enjoyable than the first half. But Pirsig has more sensible things to say about the relationships between people and machines in the first half than a lot of books say in both halves. Don't let that title throw you.

Peter Kugel
Chestnut Hill, MA.

* * *

The Eco-Spasm Report. By Alvin Toffler. $1.50 paper. Bantam Books, New York.

Despite the slightly erotic overtones of the title, our old friend of *Future Shock* fame is interested in economics rather than sex this time around. Toffler's book was written on his own authority at white heat in order to alert the reading public of the dire possibilities of the future. As he puts it in his wonderfully cliche-ridden style, "our world could end not with a bang or whimper but with an eco-spasm."

The eco-spasm evidently signifies the end of industrial society as we have known it, with a disintegration of our present economic organization regardless if it be capitalist or communist. Toffler visualizes our present recession and inflation as the warning symptoms of the emergence of a new post-industrial society evolving painfully into a super-industrial world which will still be technological but no longer industrial in its foundations. With the banking system falling apart and multinational corporations controlling ever increasing segments of the world economy, the specter of energy shortage arises to generate feelings of despair over the future. And indeed the situation is fraught with danger, but seer Toffler has the answers.

If the nations of the world will cooperate in creating transnational controls over global corporations and in acting to regulate energy shortages, a start toward a tolerable future can be made. Employment and economic policy making must take into account all facets of social change as well as the global effects of their decisions. But above all, Toffler stresses the need to convert participatory democracy into a reality in order to finally allow the peoples of the planet a meaningful voice in their destinies.

Toffler's book provides glib and often superficial answers to momentous questions, but if it sets people to thinking it may be a worthwhile contribution after all.

Norman Lederer
New York, NY

Computers In Society: The Wheres, Whys and Hows of Computer Use. Donald D. Spencer. 180pp. Hayden Book Company Incorporated, Rochelle Park, New Jersey.

Mr. Spencer, President of the Abacus Computer Corporation, presents a paperback describing basically what computers are, how and why they are being used, and what the future might bring. It is a non-technical treatment for the beginning student and layman of the applications of computers in a wide range of areas. None of the applications are in depth (but that is not the author's intent).

The main benefit to the reader is a description of what the computer does and can do in such areas as the Arts, Medicine, Law Enforcement, Business, Engineering, nd Education; what emerges is an appreciation for the impact of computers on society. The writing style is very readable – certainly non-technical; there is a conscious avoidance of jargon that plagues many areas (and especially alienates people to the computer profession). The illustrations are good. The plentiful cartoons are both amusing and pertinent to the text.

The book makes a point of a common fallacy of the media of blaming computers, rather than computer users, for "sensational" errors. Educating readers in this regard alone is a valuable contribution.

Appropriate for high school students, the book should be available to guidance counselors. Also as suggested reference material for beginning data processing students and as reading for computer appreciation courses. For these audiences, or for a layman seeking an overview, the book is highly recommended.

James A. Higgins
Binghamton, N. Y.

* * *

Principles of Systems. Jay W. Forrester. 360 pp. $10.00 (paperback). Wright-Allen Press, Cambridge, Mass.
World Dynamics. Jay W. Forrester. 142 pp. $12.00. Wright-Allen Press, Cambridge, Mass. 1971.

It is the year 12,068 of the Galactic Era.

". . . you will learn to apply psychohistory to all problems as a matter of course. – Observe." Seldon removed his calculator pad from the pouch at his belt. . . . Red symbols glowed out from the gray. . . . "Put it into words. Forget the symbolism for a moment." "The Empire will vanish and all its good with it. Its accumulated knowledge will decay and the order it has imposed will vanish. Instellar wars will be endless; interstellar trade will decay; population will decline; worlds will lose touch with the main body of the Galaxy." . . . "Enough. And what of the numerical probability of total destruction within five centuries?" . . . "About 85%" . . . "Not bad," said Seldon . . . ,"but not good. The actual figure is 92.5%"[1]

In 2024 AD the earth's population was just over seven billion and the quality of life was better than a hundred years previously. This was achieved through efforts in the midseventies to reduce the rate of pollution and the rate of natural resource usage while increasing both the rate of capital generation and the rate of food production. Unfortunately a catastrophe of unparalleled proportions occurred during the next thirty years. The population was decimated. By 2060 only a little over one billion people were still alive.

The first account is science fiction from Asimov's "Foundation". The second is a computer-generated prediction found in Forrester's "World Dynamics". Psychohistory is a figment of Asimov's imagination, but what of World Dynamics? Is it a powerful new tool to understanding or is it also science fiction?

The need for better tools to understand social, economic, business, and political systems has been evident for some time. When a law is passed, its actual effects are often quite different from the intended effects. After the initial novelty wears off, innovative programs in education are frequently found to be worse than the shortcomings they were designed to eliminate. Many public housing projects have deteriorated becoming more intolerable than

the slums they replaced. In St. Louis it has even been necessary to demolish some of the worst after they were barely twenty years old. This situation is in stark contrast to that found in engineering and the natural sciences. As each Apollo flight blasted off to the moon, there was little real doubt that it would work. Although a hundred million dollar building or bridge may employ a new design, no one expects collapse. The few failures are the exception.

In the midfifties with the aid of a Ford Foundation grant, the Industrial Dynamics program was launched at MIT in order to reduce these disparities. The aim was the development of dynamic modeling techniques which would promote understanding and prediction in the social sciences. The first book evolving from this program, "Industrial Dynamics" by Jay W. Forrester, appeared in 1961. This was followed by several others, but it was not until the publication of Forrester's "World Dynamics" that the efforts were greeted by extensive coverage in the popular press. Most of the popular discussions actually centered on the book "The Limits to Growth" by Meadows, Meadows, Randers, and Behrens III which employed an improved version of the world dynamics model.

If one simply desires the results, then "The Limits to Growth" is the book to read. For those who want to understand the techniques, "World Dynamics" is the better book, though its model is more primitive. In the latter, knowledge of the systems dynamics approach is assumed. This background can best be acquired through "Principles of Systems".

"Principles of Systems" is an introduction to the terminology and techniques used to model dynamic systems. It begins by explaining the role of feedback loops in systems, and goes on in Chapter Two to discuss both positive and negative feedback loops of first and higher orders. These ideas are illustrated with a model explaining growth and saturation of sales. Unfortunately the model used is more complicated than it should be so early in the book.

In Chapter Three, the distinction between simulation and analytical solutions is made. Although it has been conceptually possible for many years to employ dynamic models in such areas as business, this has actually been attempted only since the development of economical computers. Without computers we must resort to hand simulations which are costly and lengthy or analytical solutions which can be hard to obtain.

In later chapters we learn general principles for developing dynamic models, the role of rates and levels, and the necessity of alternating rates and levels. The reader is shown how to express such models both as diagrams and as sets of equations.

Dynamic models are actually sets of coupled differential equations expressed in integral form. To solve these models we begin with the initial values of the variables. After choosing a suitable finite time interval, we evaluate the equations to obtain the values of the variables at the new time. This iteration continues until the behavior of the model is known during the relevant time span. Though the relationship between the dynamic models and differential equations is mentioned, the book is remiss in not including a chapter explaining how to translate between the two notations.

The flows within models are classified into conserved flows and information links. The importance of information as connecting tissue in systems is stressed. It is information which alters flow rates.

Numerous diagrams, graphs, and tables contained in the book do much to clarify the presentation. Over one half of the book is a workbook containing both problems and solutions. Many of the simulations are designed to be iterated by hand. The others are intended to be run on computer systems containing the DYNAMO compiler. Unfortunately, most people do not have easy access to such computers. Fortunately, it is fairly easy to translate the DYNAMO notation into computer languages such as BASIC. It would be helpful if the book included an explicit discussion of this procedure.[2] When undertaking such a task, it is important to write subroutines to carry out frequent calculations such as table interpolation and graphing.

The book was written for college students beginning their studies in the MIT systems dynamics program. It can be read profitably by anyone having at least a good understanding of high school algebra and familiarity with any of the popular programming languages.

This is a good introduction to modeling dynamic systems, but it can and should be updated as soon as possible. It has been around too many years as the second preliminary edition.

After reading "Principles of Systems", one is in a good position to understand "World Dynamics". "World Dynamics" is most useful if viewed not as a prediction of the future, but rather as an illustration of the procedure for constructing dynamic models. It is often surprising how few variables are required to simulate complicated systems. "World Dynamics" begins with a short discussion encouraging the use of models in understanding behavior. It then describes the actual model, and finally gives specific results.

The world model contains five levels: population, capital investment, natural resources, fraction of capital devoted to agriculture, pollution, and the rates controlling these levels. Since it is a highly aggregated model, factors such as geographical dispersion and transportation are not included. Although it is easy to offer suggestions for improving the model, such improvements also complicate the model. Once we understand modeling, it is always possible to construct more realistic models if we are seriously interested in the results.

Constituting over one fourth of the book, the third chapter, contains the dependence of the rates on the levels in both numerical and graphical form. The graphs are very helpful in visualizing these relationships.

The fourth chapter includes the actual results of the model. Most runs cover the time span from 1900 to 2100. The results are also displayed in graphical form. After exhibiting the basic model's behavior, a variety of alternative assumptions are explored. It is important to realize that this type of study does not give the best strategy, but illuminates the consequences of alternative strategies.

In the fifth chapter some obvious strategies are explored and are found wanting. Often strategies looking good in the short run have disastrous long term consequences.

For those seriously interested in dynamic models, appendices B and C are particularly helpful because they summarize the equations of the world model. These equations are designed to be run on a DYNAMO compiler, but, as previously mentioned, can be translated into BASIC or other languages with a modest effort. Such an effort probably gives a far better insight into the structure of dynamic models than simply running the model on a DYNAMO compiler.

The style is readable and the book is well laid out. There are a few minor errors. For example, the rate controlling the level capital-investment-in-agriculture fraction is missing from the complete system diagram. This book can be read and understood by anyone who has read "Principles of Systems".

Should these books be bought? Yes, even though they are slightly overpriced. As computers become cheaper and faster, we can expect greater use of dynamic models. These models will become a more integral part of the decision making process on all levels. Bad models will always give unreliable results even though they are computerized. Our best hope for preventing abuse of these models is an informed population understanding both their power and their limitations.

William H. Rybolt
Babson Park, MA.

[1] Asimov, Isaac, *Foundation.* Avon Books, New York, N. Y. 1971.

[2] Anderson, Jay Martin, *Dynamic Modelling Using FORTRAN IV.* In *Creative Computing,* May–June 1975, p. 59.

CREATIVE COMPUTING
Feature Review

34 Books on BASIC

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Installment Number 4.

This group review of 34 books on BASIC started in *Creative Computing*, Vol. 1, No. 3. Five to seven reviews appear in each issue. More next issue.

15. *Time Sharing's BASIC Language*. Pub. 1970, by General Electric Training and Education Programs, Bldg. 23, Rm. 290, 1 River Rd., Schenectady, N. Y. 12345, 250 pages, 8½ x 11, $6.95 (paperback).

A programmed instruction text of average value. Rating: C

This is the only programmed instruction text in the group. "Information is presented in frames – easily assimilated units of information. You test yourself on the information in each frame before you go on to the next," and so on, for 6½ pages of introduction on just how to use a programmed instruction text. Unlike the more complex PI texts, this one does not ask the reader to skip to one place or another, depending on which answer he gives to a question, so that if he answers incorrectly he will be given additional material on that subject, before getting back on the track again. The reader of this book simply continues straight through.

However, there are seven pre-tests throughout the book, each with up to a dozen questions that, if all are answered correctly, allow the reader to skip over the following chapter. Thus a highly informed reader could read only the seven pages of pre-tests and finish the book in minutes, if he felt like playing such a game. For the less well informed, the pre-tests indicate to which frames a reader should turn for help on each question missed.

The book insists that the reader write the answers on a separate sheet of paper. "It's part of the learning process, according to current learning theory and experimental evidence. To get the most you can out of this book, you *must* write the answers."

Questions are asked on almost every page; the answers, in the right-hand column, are to be covered up with the provided cardboard mask until the reader has answered the question in his head. To keep the reader from glancing at an answer on an opposite page, only the right-hand page is used; after 121 pages, there is this note: "For next frame, turn the page, then turn the book upside down and continue."

This method of programmed instruction seems to require much white space; the actual text takes up only about 50 percent (or less) of the page.

There are seven sections: Time-Sharing Computer Systems, Remote Terminal Familiarization, BASIC System Commands, BASIC Program Statements, Paper Tape, Advanced BASIC (editing commands, functions), Matrices. A "Comprehensive Exam" of 28 questions completes the main text. There is an appendix on error messages, and another on BASIC limitations (due to limited storage).

The book starts off very simply, with a two-line program using PRINT and END, and proceeds very slowly. Nearly every point is gone over several times; there are six pages on E-notation and decimals. The first program of any real complexity is on page 193, and consists of 20 lines that demonstrate the use of lists, tables and loops in computing total sales for several salesmen. The program is explained briefly but adequately. The next long program, on page 200, has 32 lines that compute the greatest common divisor, but with very little explanation.

For a book that starts off so slowly, this one goes much too fast at the finish; the last program manipulates a Hilbert matrix without even bothering to explain what a Hilbert matrix is, or what it can be used for. The last section is on matrices, with such an emphasis that one can only conclude the authors are terribly fond of matrices.

This is one of three books (the others are Gross & Brainerd (22) and Farina (3)) to note that only program lines should be punched in paper tape: "do not allow the program name, date, etc., to be punched. Otherwise this information will enter as unnumbered program statements which will result in an error output when you try to run the program."

The biggest fault of this book, aside from its insipid text and the fact that it doesn't require the reader to write a single program, is its lack of an index.

* * *

16. *BASIC Programming*, by Paul W. Murrill and Cecil W. Smith. Pub. April 5, 1971, by Intext Educational Publishers, Scranton, Pa., 154 pages, 8½ x 11, $6.00 (paperback).

Straightforward, thorough, simple, and good. Rating: A

This book is very well designed, with much thought given to readibility. Programs and runs are in Teletype originals; all statements and program lines in text are in boldface type.

There are eight chapters: Introduction to Digital Computers, Simple Programs (using six statements), Transfer of Control, Loops, Arrays, Input/Output, Functions and Subroutines, MAT Statements. The three appendixes are: Intrinsic Functions, Flow-Chart Symbols, and Solutions to Selected Exercises.

The exercises at the end of each chapter are outstanding in quantity, quality, and variety. They are taken from various fields, such as mathematics, finance, engineering, etc. The chapter on loops, for instance, includes 20 excellent exercises, covering 10 pages and involving interest, factorials, capital recovery, depreciation, evaluating series, finding roots, evaluating integrals (three methods), and ends with one on solving higher-order differential equations.

The text coverage is thorough, and includes many small points that other authors skip over. The authors note, for example, that "it is possible to transfer to a REM statement, but this is effectively the same as transferring to the first executable statement following the REM statement."

This is a college-level text: "most of the problems . . . can be comprehended by a college freshman or even a senior high school student." Most of the problems, yes, but there are many, such as the problem using a fourth-order Runge-Kutta to solve a differential equation, that would certainly mystify most college freshmen, and many college seniors. The book would certainly be useful to many high-school students, if there is an instructor on hand to clarify the difficult points.

The authors are the only ones to note, "for the student who is concerned about programming in the most efficient manner," that execution of B*B is somewhat faster than that of B↑2. Smith (30) notes that "if the exponent is small – 2 or 3 – it is customary to use the asterisk," but gives no reason for doing so.

One must dig to find something negative to say about this work. The authors recommend using a zero as the flag for the last DATA item (they are not alone in doing so) and although they do say it should be used only when the programmer knows that none of the data items is zero, it would be better not to take chances, and to use a very large or very small number. The section on files is very short, only 3½ pages. The authors explain this brevity by noting that "Unfortunately, the versions of BASIC for different systems seem to differ more in regard to the features pertaining to files than in any other respect. We shall consequently have to discuss in terms of generalities to some extent." These two points, on zero flag and files, are trivial in comparison with the many good points of this excellent text.

* * *

17. *BASIC: An Introduction to Computer Programming Using the BASIC Language,* by William F. Sharpe and Nancy L. Jacob. Pub. May 1971 by The Free Press, div. of Macmillan, New York, N. Y., 177 pages, 6½ x 10, $7.95 (hardcover), $3.95 (paperback).

Starts out fine, well written, but gets much too hard except for top students. Rating: for the first seven chapters, A; for the remainder, C

This is a revised edition of Sharpe's August 1967 book with the same title, same publisher, 137 pages. The first seven chapters are essentially the same; a few paragraphs have been added, several paragraphs reworded, some problems added, a different printer used for the terminal output, and the word "labels" changed to "strings."

After chapter seven, the earlier book had four appendixes: the Dartmouth/GE system, the UWBIC system, "some useful programs" (critical path, grading, questionnaire analysis, regression and correlation, simultaneous linear equations, subroutines for automatic file maintenance), and a summary of the language.

The revised edition eliminates all four appendixes, substitutes a chapter on conversational programming and five on extended BASIC, and adds an index. All or most of the new material was apparently written by Jacob.

There are eight chapters in Part I on Essential BASIC: Introduction, Getting Started, Conditional Transfers, Reading and Printing, Loops, Lists and Tables, Functions and Subroutines, and Conversational Programming. Part II, on Extended BASIC, has five chapters: More on Strings, String Applications, Matrix Commands, Programmer-Defined Functions, and Additional Features (ON-GOTO, RESTORE, TAB, expanded IF, files).

The problems at the end of each chapter are immediately followed by the answers in full. These problems are not all as simple as they may look at first.

One first impression is that much thought has been given to readability. The programs and runs are all printed by Teletype on shaded backgrounds to set them off, certain program lines are indented, and two hyphens are used between REMARK and the remark itself. The flowcharts are elegant, with shadow-lines that give a three-dimensional effect.

The authors start right off, on page 7, with "here is an extremely simple program," and they present one with 21 lines. However, it really is simple, and five pages are taken to explain it in detail.

Here is another book concerned with the appearance of output; a printout without headings is called "hardly very elegant output."

The second program, also simple, is 42 lines long, and uses 20 REMARK lines, 8 of them blank. This is one of four books to use blank REMARK lines, and to indent certain program lines, mainly loops. It is also the only book to explain why variables should be initialized to zero, and one of the few to discuss minor print zones.

The chapter is Reading and Printing is excellent, with fine problems; the chapter has nice and explicit detail work, going into all the odds and ends.

The first half of the book is well written, in an easy, comfortable style, seeming to catch every little important detail. There are some curious omissions: no examples of switch sorting, nor of lists or tables. There are very few program runs in the book – only eleven. At times the book seems aimed at math majors: standard deviation is explained in one sentence in a footnote. Page 40 starts a complete withholding program of 50 lines which, although straightforward, requires so many inequality statements that it may be quite confusing so early in the text; this is a little too soon to separate the men from the boys. The last program in this first half is for playing roulette, and although it has many explanatory remarks, it is still very hard to follow for a beginner with no teacher to turn to.

The general picture changes from page 83 on. In the chapter on Conversational Programming, there is a program of four lines, another of 13 lines, and then a whopper, 136 lines, for playing blackjack, taking up, with its explanation, almost half the chapter. An interesting program, but why hit the reader over the head with such a long one only halfway through the text?

There are few useful applications other than a financial language called FL-1, which gets into more mathematics than many readers may be able to understand or care for. This language takes up the entire chapter on String Applications, and may be appreciated only by the top-ranking math students. They might also go for the program that generates 1,000 random normally-distributed numbers, but the average reader probably would not.

The imbalance resulting from the inclusion of these fancy mathematical programs is not realized until the section on files, which covers only four pages. A better balance might be more on files and less on higher math.

Although Part II on Extended BASIC "is designed for those persons with deeper interests and/or the need to use computers for more complex tasks," the text might appeal to a much wider audience if it didn't require a knowledge (or appreciation) of statistics, and use simpler programs in several instances.

* * *

18. *Computer Programming in BASIC*, by Joseph P. Pavlovich and Thomas E. Tahan. Pub. June 24, 1971, by Holden-Day, San Francisco, Calif., 345 pages, 6 x 9, $8.95 (paperback).

Generally quite good, with many examples, much detail, and a nice variety. Rating: B

A somewhat mixed bag, although mostly on the plus side of the ledger. The back cover says that, for the reader, this book "acquaints him generally with the use of computers in a time-sharing environment as well as in a batch-processing environment." Yet the word "batch" isn't used in the book once. The book is said to "teach by example"; yes, it does, with nice long comments on the various parts of each program, and with many examples. The back cover also says the book is "designed not only for the experienced programmer, but also more especially for the beginning program." A neat trick if true, but it isn't.

A very neat format, with all program examples in Teletype originals, set off by horizontal lines across the page, above and below each program and its output. There are many of these examples. The authors go into many areas, such as exponential notation, in great detail.

There are eleven chapters, each divided into sections: time-sharing; Teletype; PRINT, arithmetic operation, corrections, LET, READ and DATA, INPUT; built-in functions, numbers in BASIC; flowcharts, IF-THEN, alphanumeric data and string variables, GO TO, loops, FOR-NEXT, DIM; GOSUB-RETURN, MAT, CHANGE, defining functions; debugging, solutions of triangles, graphs, real zeroes; matrices; statistical program, area under a curve; summary of BASIC statements; system commands. There are excellent exercises at the end of most of these sections, although without answers. Each chapter ends with a summary of what the reader has learned.

The seven appendixes give a variety of programs (and runs) in seven categories: algebra (15 programs), geometry (3), trig (1), analytic geometry (2), calculus (4), probability (1), special (4). The last of the specials is a 130-line program that prints "A Meaningless Technical Report" by randomly combining phrases used in the aerospace industry.

Two ingenious lines in the dice-game program are all that's needed to take care of the five combinations that win or lose on the first roll:

```
410 IF (R-7)*(R-11)=0 THEN 490
420 IF (R-2)*(R-12)=0 THEN 530
```

(Kemeny & Kurtz (2) do it with a single ON-GOTO statement using 11 branches; Smith (10) uses four IF statements).

The authors are among the very few to note that quote marks around a space in a PRINT statement will skip a column, in some systems.

The RESTORE statement is explained too soon, on page 38, with an example of no significant value. And instead of explaining built-in functions simply, as almost all other authors do, these define it in all too stiff and formal mathematical terms, using words such as "domain," "range" and "set." Fine for those familiar with set theory; Greek to the rest.

Although a great variety of flowcharting symbols is used in these books, this is the only one to use a triangle – for a starting or stopping point (Peluso et al (20) use it for an entry point) – even though it is the ANSI symbol for off-line storage.

Multiline function definitions are presented as though available on any BASIC time-sharing system, instead of only a few. And although the section on this subject contains some clever programs, they are difficult to understand, even with the explanations.

Ten pages are taken up with a long tutorial on trigonometry, leading up to one big program that solves any triangle, given a side and any two other parts. And there are nine pages of tutorial on matrices, a total of 19 pages that might have been better spent teaching BASIC.

By page 180, the book has gotten quite complex for a non-mathematician, with a program for finding real zeros of a function, which requires very close attention to be able to follow, and is very difficult to do so.

* * *

19. *An Introduction to the BASIC Language*, by John E. Skelton. Pub. Aug. 17, 1971, by Rinehart and Winston, New York, N. Y., 158 pages, 6 x 9, $3.95 (paperback).

Although fairly well written, there is too much padding and too little coverage of some areas. Rate: C

The preface notes that this slim paperback is an introductory text "intended for use at the high-school junior or senior or the college freshman level . . . . The text is not intended to be an exhaustive treatment of the BASIC language; in fact some features of the language (such as MAT) have been left out."

Not for lack of space, surely. There are many blank pages between chapters, and a whole page is used up for each chapter number and title. Some 20 percent of the book (over 30 pages) is blank or almost-blank pages, which could have been used to better advantage, such as providing more examples, of which there are all too few. And there is too little on lists and tables, only 2½ pages, to be really worthwhile. An entire chapter is devoted to READ and DATA, a full 2½ pages, with no mention of RESTORE.

There are ten chapters: The Problem-Solving Process; Computation: LET; Input/Output: INPUT and PRINT; Control Statements: GO TO, IF and END; Lists and Tables: DIM; Computing the Values of Polynomials (algorithms, flowcharts); Loops: FOR and NEXT; READ and DATA; Functions and Subroutines: DEF and GOSUB; Some More Programming Techniques. The exercises at the end of each chapter are few, without answers.

The real padding is in the eight appendixes, 42 pages showing how eight different time-sharing systems operate. Seven of these are accompanied by exactly the same photograph of an ASR33 Teletype, taken from a low angle so that only the tape unit shows clearly.

The writing style is rather dull. The first sentence is enough to put one off: "It is a well-known mathematical fact that any integer can be expressed as the product of prime numbers." And the text is not always easy to follow. The FOR statement is introduced this way: "The general form of the FOR statement is: LN FOR CV = EX1 TO EX2 STEP EX3, and corresponding to this statement somewhat later, LN NEXT CV." A practical example would be much better.

There are some nice things to be said about this book. Although some authors do mention that a flowchart should be checked out by hand calculations, Skelton is the only one to show exactly how this is done, several times, by giving a table of, for instance, "Calculations to Check Flowchart of Figure 1-1." There is a good section on number representation, and a detailed discussion of rounding.

This, then, is a 62-page book stretched out to 158 with many blank pages, 42 pages of not-too-useful appendixes, and a few exercises. Not quite cricket, really.

* * *

20. *Basic BASIC Programming: Self-Instructional Manual and Text*, by Anthony P. Peluso, Charles R. Bauer, and Dalward J. Debruzzi. Pub. Sept. 13, 1972, by Addison-Wesley, Reading, Mass., 274 pages, 8½ x 11, $7.50 (paperback).

An excellent book, very thorough in imparting information. Rating: A

There are many excellent features in this book, and very few drawbacks. The self-instructional feature involves blanks or questions, following short portions of text called "frames." The reader is asked to place a shield over the page to cover the correct responses which follow the blanks or questions immediately, just below a dotted line across the page, which indicates that a response is required. There are tests throughout the book, at the end of each chapter, plus five tests within Chapter Two. All answers are at the back of the book.

There are twelve chapters: Introduction to Computers, Fundamentals of BASIC, Input/Output (PRINT, END, READ, DATA), Branching, Looping, Program Preparation and Processing (including flowcharting), Advanced Looping, Advanced Branching, Advanced Input/Output, Special Functions and Subroutines, Arrays, Matrices. There are eight appendixes: Practice Problems, Hints to Practice Problems, Error Messages, Errors While the Program is in Progress, Control Commands, Limitations on BASIC, Sample Programs, Solutions to Exercises and Answers to Tests.

The best feature of this book is its thoroughness. It starts out slow and easy, goes a little faster starting with Chapter Four, but remains relatively slow. There are over ten pages on the order of operations. The first complete

program is on page 52, four lines long. The IF-THEN statement is covered so completely that even the slowest learner should be able to understand it. The chapter on Advanced Branching is excellent, covering some areas that few other BASIC authors do. In these pages is one of the few full and excellent explanations of the DEF statement. Arrays are gone into fully, with many detailed examples. Appendix I contains 25 practice problems; "A few of these problems require a knowledge of first-year high school algebra, but most problems require no mathematical training." Appendix VII contains ten sample programs, with flowcharts, input listing and output, on interest, largest and smallest numbers in an array, averages, etc. Simple but instructive.

Another unique feature is that by page 25 the reader is writing program statements based on word descriptions of the desired function.

The entire book is typewritten, except for some Teletype output after page 106, and is double-spaced, so it could be half as long, although not as easy to read. The self-instruction part of the book uses very little extra white space, in comparison with, for example, the General Electric book (15).

The authors use a zero as the final data element to "provide a means of terminating execution of the program." Only three other books use a zero; most prefer either something like 99999, or a very large number such as 1E20, because zero could in some cases be a valid data element. There isn't much on matrices; 13 pages cover both arrays and matrices, with only one example of manipulation: addition of matrices. However, the slighting of this area may be understandable in light of the back-cover note that this is "written for beginning students with little or no background in the computer field." Although some statements are thoroughly covered, there are only two pages on GOSUB and RETURN. Appendix II contains Hints to Practice Problems to help solve those on the preceding pages, but without answers to any of the 25.

All in all, a very satisfying text, written by people who not only have teaching experience, but who know how a teaching text should be written. Some 40 BASIC statements are covered (of which 11 are for matrices, 9 are built-in functions, and two are logic operators for "advanced branching").

* * *

21. *BASIC Programming for Business*, by Joseph C. Sass. Pub. Nov. 1, 1971, by Allyn and Bacon, Boston, Mass., 310 pages, 5¾ x 8¾, $7.95 (paperback).

Several unique and outstanding features, but sticking to a rigid method causes serious problems. Rating: B

This book has many things going for it. It is small and convenient to hold, well designed in both layout and typography. There are two unique features of great merit. The first is the use of examples of every statement: a set of proper ones, and another set of statements illustrating common errors occuring with that statement. The second outstanding feature is the use of a column of description alongside the example statements, explaining each one, not in the following text, but right up where it can be read with the statement, right where it is most needed.

There are nine chapters: Introduction; BASIC Commands; INPUT, READ-DATA, and REMARK; Transfer Commands; FOR-NEXT Loops and Arrays; Additional Features; Matrix Commands; Files; Samples With Solutions and Additional Problems. There are appendixes on error messages, correcting errors, system commands, terminal operation, and an eight-page glossary.

The text combines three kinds of type. The main body is in a sans-serif font, while the word BASIC, and all statements, whether in the text or in example groupings, are in serif type. The programs themselves are Teletype originals, reduced (when required) to a maximum 4½-inch width.

The main programs are based on two problems, bank deposit and salesmen's pay, which start small, and are expanded upon in each new chapter.

Each chapter is divided into sections; each important section is followed by exercises that pertain only to the preceding material. Answers are provided for selected exercises.

But all these fine features are not put to the best use, and the resulting book does not live up to its initial promise.

The bank deposit and salesmen's pay examples, although standard types, tend to become dull after the reader has seen them so many times, getting longer and longer as they get more complex. There are 15 of the bank problems and 12 pay problems. Although, for instance, the BANK10 program has some quite different statements than BANK09, these differences are not explained very well. And what is said, is confusing. The buildup of a simple program into more and more complex ones begins to bog down on page 119, due to their own weight, complexity, and single-mindedness. Shorter programs could have been used much more effectively to highlight the new types of statements used. BANK 10 could have been made much more understandable with the use of some examples at vital points in the discussion, but the author's rigid format, which puts examples only in groups that are not related to any of the programs, does not allow using examples where they are most needed.

The writing is another drawback; in many places it is pedantic and dull. On page 2: "The user has access to the computer by means of a typewriter-like device called a remote terminal. . . ." Even worse is on page 4: "One of the most popular terminals being used to utilize the time sharing computer. . . ." There is much excess verbiage, as on page 2: "The memory unit performs the function of retaining or storing for later use the data or information that is transmitted to the computer by the input function." On page 12: "The purpose of flowcharting is fourfold."

Sass is the only one to trace, although briefly, the origins of BASIC, from MIT down through JOSS. Also unique is the only illustration in all 34 books that graphically shows what Teletype print fields are. Also unique: three different ways of writing the first program, to show the reader that "there are many different, but all correct, solutions to the same problem when writing programs." Sass is one of the few authors to use string variables right from the beginning; page 15, in this case.

Although there are many exercises, and they are well placed in the book, the answers at the end of the book are to only a select few, usually only the first and third ones. Fine for school use, but hard on the lone reader.

Sorting by the "copy method" is explained only by a flowchart, without any accompanying, amplifying text.

The book doesn't live up to its title. There is nothing on business programs until page 189, other than the deposit and pay programs, which are standard in many programming texts. The first business program is on page 189, on production management, illustrating the use of matrix statements, just to solve two equations in two unknowns. Chapter 9, beginning on page 223, contains seven business problems, which is about all the claim this book has to being business-oriented, other than that item on page 189. The seven problems are on: "switch method" of sorting, sort using a key, marketing simulation, depreciation of an asset, interest, inventory simulation, and production simulation, a total of 29 pages. Two of the programs, marketing simulation and depreciation, need explanations, but don't get them. The "switch method" of sorting is not properly described: it is said to be done "by swapping locations with *another* value." The swapping is of *adjacent* pairs.

Appendix B shows a six-line program as run on twelve different systems. There is very little difference in the twelve runs, so why take up a dozen pages with them? The stated reason: ". . . to illustrate the slight differences in sign-on and sign-off procedures for different commercial sharing vendors." Fascinating.

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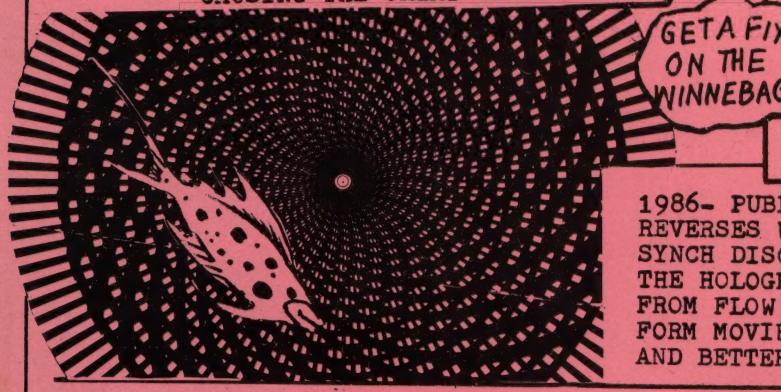
SPANOVISION

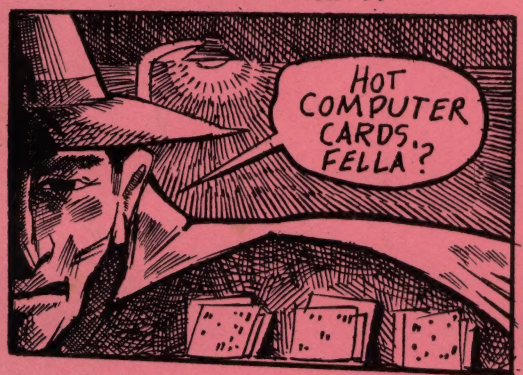
BETWEEN 1975 AND 1985 THE DIVISION BETWEEN TECHNOLOGY AND THE PUBLIC GREW IMMENSELY. COMPUTER RELIANCE INCREASED WITH THE POPULATION, AND THE INTRUSION OF MACHINE IN HUMAN AFFAIRS DREW GREATER NEGATIVE REACTION THAN ANTICIPATED. THE HEIGHT CAME IN 1985 WHEN A COMPUTER ERRONEOUSLY SCEDULED NINE MILLION RESERVATIONS IN YELLOWSTONE PARK, CAUSING THE GREAT CAMPER WARS.



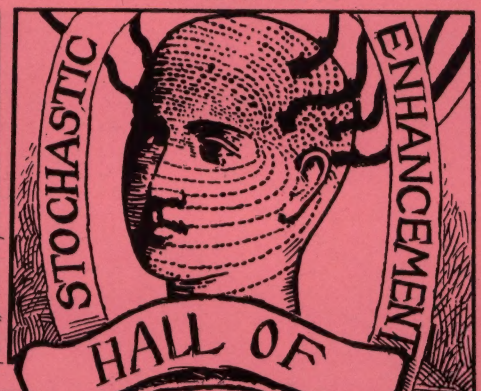
1986- PUBLIC OPINION OF COMPUTERS REVERSES WHEN THE COMPUTRON-HOLOSYNCH DISCOVERIES GIVE BIRTH TO THE HOLOGRAPHIC AGE. EVERYTHING FROM FLOW CHARTS TO EPIC FIFTH FORM MOVIES CALM AN ENTHRALLED AND AND BETTER INFORMED MASS POPULACE.

BUT CHARLATANS ARE NEVER FAR BEHIND!

OPPORTUNISTS RUN AMOK...



CULTS ABOUND...



SOCIETY NEARS OVERLOAD.

HALL OF INVENTOR'S FAME

IN THE CONFUSION OF INFORMATIONAL GLUT, AMERICANS WHO HAD BEEN ESSENTIALLY LEADERLESS FOR DECADES ARE OVERWHELMED BY THE COMPLEXITY OF THEIR SITUATION.

BUT AS FATE FALLS, OUT OF THE QUAGMIRE OF COMMERCIAL ENTERPRISE AN INVENTION COMES TO THE RESCUE...

...AND BRINGS FAME AND FORTUNE TO ITS INVENTOR.

WHAT INVENTION COULD CAUSE SUCH A STOCK MARKET SENSATION?
WHAT DEVICE COULD MAKE POLITICIANS HONEST?
WHAT MIRACLE COULD MAKE TELEVISION FUN TO WATCH?

* F I N A L P R I N T O U T N E X T I S S U E *

WHAT GALL.

C. Johnson